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ELECTRICAL EXPORT TRADE.

The figures just available for December indicate, as did those of other recent months, that heavy electrical machinery from this country continues in demand abroad, but that exports of electrical instruments have declined, although no apparent reason can be assigned for either phenomenon. The exports of electrical machinery for December were $837,811 as compared with $635,855 in the corresponding period of 1906. The total for the twelve months was $9,735,230 as compared with $8,274,753, a gain of nearly $1,500,000. Turning to electrical instruments, we find the exports for the month only $515,701 as compared with $827,646, while for the twelve months the total was $7,725,545 as compared with $8,380,757 in 1906, a decline of over $600,000. It would seem that with the growing excellence and increasing variety of electrical apparatus and supplies, this branch of trade would be easy to build up; and it is, probably. As a matter of fact, the trouble, whatever it is, appears to lie in our trade with England.

For the month the exports to the United Kingdom fell off from $219,946 to $27,597; and for the year from $2,194,085 to the small total of $800,076—in other words, were $1,300,000 less, or more than twice the whole loss for the year in this department. The loss was chiefly made up in fact by larger exports to Brazil. It would be interesting to know just what is wrong with the English trade, but the fact is generally known that last year was very dull and dead electrically in England. This year there certainly should be revival. Few countries are so poorly supplied with all the modern electrical necessities, comforts and conveniences. After all, we have here an electrical export trade of $17,460,775 per year, evidently susceptible of development and growth and touching all parts of the globe. In these days of slacker home consumption, our manufacturers might well give such business their closer attention. If they do not, others will.

ENGINEERING SOCIETIES BUILDING HISTORY.

Mr. N. M. Forney, the distinguished mechanical engineer who recently died, was one of the many who contributed to the realization of an engineering headquarters building in New York About 1894 he advocated energetically the plan of a common headquarters in New York for the several national engineering societies, carrying on the campaign through his journal, *The American Engineer,* by communications to other journals and by personal work among engineers. The time, however, was not then ripe for the idea, but the name of Mr. Forney should not be omitted from the roll of those who kept it alive and in course of progress until the opportune moment arrived for its realization. How radical the proposal seemed at that period and for some years later is illustrated by the fact that when in 1895 Mr. Carnegie offered to take up the matter of a general engi-

neering headquarters, the plan was regarded with so little interest that no steps were taken by any of the societies to act on his suggestion. It was not until the sudden growth of the Library of the American Institute of Electrical Engineers and consequent need of quarters beyond those afforded by downtown office buildings that the idea took on a practical significance which led to its general recognition, and to its final realization through the historic A. I. E. E. Library dinner of 1903. But those who, like Forney, nurtured and fought for the idea through the discouraging years when it had few friends, and who bore the rebuffs incident to advocacy under such circumstances, should receive due credit for their disinterested labor when the object to which it contributed has been finally achieved.

Organization of Public Service Commissions.

Electric lighting and railway companies are naturally watching with some anxiety and interest the practical workings of state commissions for regulating public utility corporations which recently have been organized in several states where the plan of regulation by commission has not been tried before. Companies in states having such commissions have an immediate interest in their rulings, while companies of many other states, where commissions are likely to be established, have an indirect interest in watching which way the wind is blowing. The success of regulation by state commission must naturally depend largely on the character of men composing the commission and upon the professional standing of those employed by the commission as experts.

It is gratifying to note that in Wisconsin the recently established commission is drawing extensively for expert service on the able engineers on the University of Wisconsin faculty. The decisions of that commission so far appear to have been reassuring to the public service corporations of that state, in that they have indicated a desire to treat such companies with entire fairness. While it probably does not suit some of the politicians of various City Councils to have the corporation sandbags taken out of their hands, it is certain to result in benefit to both the public and companies of the state to have this power placed with a commission rather than with tinkering City Councils, provided the commission is always of high character.

Several weeks ago we printed a decision of the commission which has attracted considerable attention because of having authorized the raising of electric light and power rates in La Crosse, where it was shown that because of competition of two rival companies previous to their consolidation, the rates had been cut to a point where there was no profit. This decision will doubtless be of value to companies all over the country, as establishing certain principles in methods of charging which are eminently sound. Besides the question of regulation, considerable interest naturally centers around the policy of commissions in authorizing additional stock and bond issues. It is to be hoped that commissions will not rule against such issues to an extent which will hamper companies from properly extending their business. On the other hand, investment in electric light and power enterprises should not be discouraged by too low a limit on dividend rate. While the risk may be small in an established business of this kind, there, nevertheless, is some risk. The investor will not put his money in any proposition which may pay him only the common rate of interest if successfully managed, but if the business is not successful may pay less. It is too much like a game of heads I win, tails you lose.

Variable-Speed Commutating-Pole Motors.

The excellent operating characteristics of direct-current motors provided with commutating poles have been noted in our columns from time to time, and an article discussing at length the causes to which such characteristics can be attributed appeared in our issue for March 18, 1905. It is well-known that in the normal design of commutating-pole machines the voltage between the segments over the brush area on the commutator is easily kept within the proper limits, but the voltage between segments at other parts of the commutator may reach values considerably larger than is allowable in machines without commutating poles. This limiting feature of the commutating-pole machine was discussed in our issue for May 11, 1907. Our present issue contains an interesting article by Mr. A. G. Ellis giving calculations tending to show that the permissible maximum e. m. f. between segments is soon reached in variable-speed commutating-pole motors. The author finds that when the maximum e. m. f. between adjacent commutator segments is kept below the value known to result in "flashing over" with the normal machine, a many-segment commutator is required, and the machine becomes expensive to build. He has made no mention of the compensating-winding method of preventing field distortion and thereby eliminating the excessive voltage between certain segments, probably on account of the extra cost that the method involves.

In the present article the author seems not to have considered the feature mentioned on page 90 of our issue for July 13, 1907, namely, that the real limiting condition is the voltage between segments that will maintain an arc already established, and that this voltage is higher in a commutating-pole motor, in which there is no sparking at the brushes, than it is in a machine without commutating poles. It is probable that a commutating-pole motor possesses no greater tendency to "flash over" than does a motor without commutating poles having a maximum e. m. f. between segments only 75 per cent as great as that of the former machine. Moreover, the high e. m. f. that is inductively generated in the machine without compensating windings when a rapid change in the armature m. m. f. is allowed to produce a corresponding change in the air-gap flux, may be reduced to an insignificant value by the use of compensating windings, and thus the prime cause for the "flash-overs," which accompany the opening of circuit-breakers under excessive overload, may be eliminated. Incidentally it may be mentioned that flashovers may largely be prevented by placing the set of brushes in its own insulating compartment—a type of construction that doubtless will be used with extra high voltage motors.

Measurement of the Inductance of a Circuit with Normal Load Current.

The inductance of a transmission line plays an important part in the regulation of pressure at points remote from the generator, although it does not directly affect the loss of power in

transmission. When the reactance offered by the line to alternating currents is of the same order of magnitude as the resistance, it suffices, as a general rule, to observe the impedance offered by the lines, and to regard this impedance as the hypothenuse of a right-angled triangle, the resistance forming the base. From this construction the reactance, or perpendicular side of the triangle, follows at once. In cases where the reactance of the circuit is very much less than the resistance, the measurement of impedance is all adapted to determine the amount of inductance present, because a small error in measuring the impedance may involve a large error in the reactance deducted therefrom. Another method has to be adopted in such a case. The method suggested in the article on page 299, by Mr. C. C. Chapin, is to employ a differential alternating-current galvanometer, and a non-inductive resistance equal to that of the line. By this means the resistance drop in the circuit can be eliminated, and the reactance drop can be brought into prominent effect. This method has the advantage of separating the resistance from the reactance of the circuit, and of securing a differential balance for each independently.

The results reported of measurements on duplex wire have special interest because this wire, as is well known, is made of copper and iron associated in definite proportions. The results indicate that with relatively feeble line currents, the inductance of this wire is substantially the same as when copper wires only are used. As the line current increases in strength, the magnetic force in the iron increases, and this in turn meets with an increasing permeability in the iron, so that the inductance of the duplex wire rises steadily with the current strength. It is certainly not the first time that the variable inductance of iron wires has been brought out experimentally Such observations have been obtained during a number of years. It is probably the first time, however, that the variable inductance of iron wires has been experimentally indicated by this particular method of measurement. It is important that data should be accumulated upon the permeability of iron and steel conductors under varying conditions of alternating-current service. It is now common practice to use steel rails as a return conductor in alternating-current traction, and the variable permeability of the steel affects the reactance of the circuit profoundly. In such cases the phenomenon is much complicated by the complex cross-sectional area of the steel rails, and also by a variable skin effect.

LUMINOUS EFFICIENCY AND THE MECHANICAL EQUIVALENT OF LIGHT.

The ordinary carbon-filament incandescent lamp has, according to recent measurements, a luminous efficiency of about three per cent on the basis of white light as standard, and of about two per cent on the basis of that particular yellowish-green monochromatic light to which the human eye is most sensitive. Compared with electric motors, heaters or other translating devices, this efficiency is shockingly low. Imagine the consternation of a prospective consumer who should learn that a good device would net him only three per cent of the full possible yield. Nevertheless, in the carbon-filament incandescent lamp, the consumer has to be satisfied with three per cent utilized and 97 per cent wasted on the premises as warmth. It is true that the tungsten-filament lamp brings up the efficiency to nearly 10 per cent, which offers an enormous relative increase, and yet gives absolutely only a slight reduction in the appalling deficit. A paper has recently been communicated by Dr. C. V. Drysdale to the Royal Society on some new measurements of the mechanical equivalent of light. The power radiated from a Nernst filament was measured in watts by the use of a thermo-pile bolometer. Simultaneously, the candle-power of the filament was measured photometrically. From these observations it appeared that one watt of white light gave 8⅛ candle-power.

A similar series of observations conducted on the carbon arc lamp gave the result that one watt in white light was equivalent to 12½ candle-power. The higher candle-power equivalent of one watt in arc light is attributable to the higher temperature of the carbon in the arc as compared with the incandescing filament. The mean of the two observations gives approximately 10 candle-power as the equivalent of one watt of white light. If then we could force an incandescent lamp to radiate its energy exclusively within the visible spectrum; that is, if we could somehow prevent its throwing off invisible radiation as heat in the ultra-red region of the spectrum, we should expect to find that the lamp absorbed one-tenth of a watt per mean spherical candle-power, instead of over three watts per mean spherical candle-power. Moreover, in that portion of the spectrum between the green and yellow, where the wave-length attains a length of 0.54 micron, one watt of luminous energy produces about 17 candles, instead of the 10 candles for the more generally distributed colors of white light. If we could put some kind of screen over an incandescent lamp which would stop the escape of all radiation except just at this color, we might expect a 17-mean-spherical candle-power lamp to absorb one watt at terminals. The light would then be highly efficient but rather glow-worm like and æsthetically undesirable.

The paper indicates that the convection loss of heat from the incandescent lamp, by the movement of air, was only about two or three per cent, which is a mere trifle compared with the loss in radiation in the invisible part of the spectrum. There are two ways of regarding the existing inefficiency of luminous sources. One is to find fault with the human eye, which fails to respond to good radiation when the wave-length happens to exceed 0.76 micron, and the bulk of the radiation from a lamp generally does possess a greater wave-length. The other way of considering the matter is to bewail the bad radiative behavior of highly heated bodies from the optical standpoint. It certainly seems hopeless at the present time to expect much better performance from a hot filament than we now obtain from tungsten. Nevertheless, there is so much room for improvement that we may well hope for better luminous efficiencies in times to come. It is not ridiculous to expect luminous efficiencies of 80 or 90 per cent. We know that gases have selective rates of molecular oscillation, and do not require to be highly heated in order to be thrown into oscillation. Already the mercury-vapor lamp points to a greatly reduced waste of power in dark radiation. One thing is certain, namely, that the misappropriation of the term "efficiency of an incandescent lamp" to the power consumed at terminals per mean horizontal candle-power covers a great and woful deficiency.

National Electric Light Association.

The next convention of the National Electric Light Association will be held in Chicago, May 19 to 22. The headquarters will be in the Auditorium Hotel, and the sessions will be held in the Fine Arts Building, which is connected with the hotel by a covered passage. For exhibits the former dining room of the hotel will be utilized, this room being in direct connection with the meeting room in the Fine Arts Building. The banquet room in the Auditorium will also be used for committee meetings.

Proposed Ohio Public Utilities Commission.

A bill has been introduced in the Ohio Legislature for the regulation of public utilities modeled rather after the Wisconsin than the New York measure. It provides for a commission of five members whose terms of office shall be five years, with salaries of $10,000 each per year. The governor is empowered to make the appointments and may remove them for cause, although a hearing may be demanded in that case and witnesses summoned if necessary. The provisions of the bill apply to all individuals, companies, corporations or associations, their lessees, trustees or receivers and every town and village in the state that may now or hereafter own, manage or operate any plant or any part thereof for conveying telephone and telegraph messages, the production and transmission, delivery or furnishing of heat, light, water or power to the public, and all street and interurban railways.

The bill provides for indeterminate permits that shall continue so long as the corporation or company conforms to the rules and regulations of the commission and the provisions and enactments of the city and village councils, rather than for franchises that shall have a definite time to run. Just and reasonable service with fair prices are required, and companies using poles, tracks, conduits and other equipment on or under streets are required, in consideration of just compensation, to allow other public utilities to use them. If they cannot agree upon the compensation, then the question shall be referred to the commission and its decision may be reviewed by the courts.

The commission shall have power to make investigations as to the value of the property of every public utility to the end that the people shall not pay rates to cover overvalued property, and the body shall also have power to compel all companies to keep uniform accounts of their business and maintain offices in some city or village in the state where the company has property. These books shall be open for inspection.

Under this bill all companies shall carry a proper and adequate depreciation account whenever the commission requires it, and the commission shall have authority to determine the rates of depreciation. This money shall be used in improvements and betterments when necessary, but if invested, the interest returns shall be credited to the fund. In order that construction accounts shall be kept separate from operating expenses, the commission shall keep itself informed of all new construction, extensions and additions, and make regulations for the same. A public utility company may enter into reasonable arrangements with its customers, with the consent of the commission, for a distribution of its surplus earnings with consumers or employees, and for a sliding scale of charges.

Companies shall furnish the commission, at the times required, information given in figures per unit, as follows: Depreciation, salaries and wages, legal expenses, taxes and rentals, quantity and value of materials used, receipts for residuals, by-products, services and other sale separately, total and net cost per unit, gross and net profit, dividends and interest, surplus and reserve, prices paid by customers, and such other items as the commission may prescribe. All information in the hands of the commission shall be open to the public, except in cases where it is to the interest of the public, information may be withheld for ninety days.

The commission may provide for the examination and testing of the product and service of any utility and the measurement of such product, all information possible to be furnished the commission by the individual or company operating the plant. Consumers may also have any appliance used in the measurement of a product tested. All public utility companies must keep on file with the commission a schedule of the rates, tolls and charges which it has established and which are in force at the time. In this connection, the commission may compel companies to keep on file in every station or office where payments are made rates and schedules of prices charged, and these may be required to be displayed for public inspection. No change shall be made in these schedules until notice is given the commission, and violations of the rules are punishable by a fine. The commission may provide for classification of the service, and in such classification may take into account quantity used, time when used, the purpose and any other reasonable consideration.

Books and records kept by the companies either in or out of the state must be produced on request of the commission. Engineers, examiners, clerks, expert accountants and other assistants necessary to the work may be employed by the commission. Every complaint made by 25 persons, firms, corporations or associations against any public utility regarding rates, tolls or charges of any kind, must be investigated. On the other hand, any public utility company may make complaint when any rate, regulation or other change or charge affects its service, and the same shall be investigated. All the rules and regulations of the commission are subject to review by the courts.

No license, permit or franchise shall be granted any public utility in any municipality where there is in operation under an indeterminate permit a public utility engaged in a similar service without first securing from the commission, after a public hearing of all the parties interested, a declaration that there is reasonable necessity for the new company. To some extent this is in the nature of a monopoly. Representative Shuler, who presented the bill, believes that monopolies, properly regulated, serve the public better than competing companies in most instances, and only where existing companies fail to furnish proper service will it be necessary to allow competing companies to operate. In order to induce existing companies which have long franchises to come under the control of the commission, councils of municipalities will be allowed to grant franchises to competing companies. The idea is to grant the monopoly feature only to corporations which choose to operate under the proposed law.

Indeterminate permits amount to a perpetual franchise if the corporations operating under them choose to conform to the rules and regulations of the commissions and the ordinances of municipalities in which they operate. After the law becomes operative no further franchises are to be granted by municipalities. Provision is made for municipal ownership of all public utilities, but before properties shall be acquired or constructed the question shall be submitted to a vote of the people. If the majority of those voting favor the move and that majority is equal to 60 per cent of the vote cast at a regular election, then the municipality shall have authority to issue bonds to acquire or construct the properties. Such bonds shall not be limited in amount by the Longworth act. Existing limitation as to the power of taxation in municipalities shall be abrogated to the extent that the municipality shall not be hindered in acquiring or constructing public utility plants.

This bill gives the commission absolute power to regulate rates charged by interurban railways and telephone companies. It cannot affect street railways which have contracts with cities, unless they voluntarily come under the control of the commission because of the indeterminate permit proposition. The commission will also have authority to supervise the issue of bonds of public utility corporations. This feature is put into the law to prevent the watering of stock and making a charge to the public for investments that have never been made.

N. Y., N. H. & H. Electric Locomotives.

Owing to various rumors that the operation of the electric lines of the New York, New Haven & Hartford Railroad have not been entirely successful, the railroad company has issued a statement which contradicts the report that the entire system has been turned over to the Westinghouse Company and declares that there is no dispute and never has been a dispute between the two companies. The report that the New Haven road owes the Westinghouse Company between seven and ten millions of dollars is declared to be untrue, the amount due the Westinghouse Company being only such as comes under the terms of the contract by which settlements are made monthly. The entire operation, both of the power house and the trains, according to the statement, are and always have been in the hands of the railroad company. The rumor that the system had been turned over to the Westinghouse Company probably arose from the fact that owing to slight necessary changes in the locomotives which demanded expert technical supervision, the Westinghouse Company was given charge of the small machine shop where such repairs are made. But even the expense of running this shop is borne by the railroad and the Westinghouse engineers were asked to take charge merely to expedite the repair work. At no time since the inauguration of the electric service between Stamford and New York has the service been discontinued; in fact, in commercial service, the locomotives furnished by the Westinghouse Company have exceeded by 20 per cent the contract guarantee, and under certain conditions have been operated up to 100 per cent over the contract guarantee. At the Cos Cob power station certain changes were found desirable and will be completed shortly, but the full capacity of the station is much in excess of the operating requirements and has at all times been found sufficient to meet the needs of the electrical service. Both companies are stated to be working together in the closest harmony. The Westinghouse Company has never had supervision over the operation of the company's power house or its trains; its connection with the operation of the electric locomotives has been to provide experts for the instruction of the engineers in the handling of the electrical machinery.

The statement issued includes a list, with their respective designating numbers, of the 20 locomotives which run between New York and Port Chester, and the 22 locomotives which run between New York and Stamford.

An official of the Westinghouse Company corroborated the above statement of the railroad company in every particular, and added that the railroad had made even better monthly payments than actually required by contract.

Industrial Education in Ohio.

The Ohio legislature will be asked to authorize the appointment of a commission whose duty shall be to inquire into the opportunities for trade and industrial education in the state and the demand for such training as schools for this purpose will afford. Through the effort of engineering organizations of the state this matter has been brought to the attention of members of the legislature and they have been shown where the state, the fifth in manufacturing in the Union, lacks much in the way of industrial training for the young people who cannot secure a higher education in engineering. Little attention has been given in the state to this subject, although it has been taken up to some extent by the public schools of Columbus, and Cleveland now has a new and magnificent building completed. Some criticisms have been made on the course that will be adopted for this school, but it is practically certain that if a wrong start is made, it will be corrected in a short time through the interest manufacturers and engineers will take in it. Prof. W. T. Magruder, of the Ohio State University, has been greatly interested in the matter of trade or industrial schools, and it is through his work largely that the subject will be brought before the legislature. He read a paper at the annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers some time ago that was effective in awakening interest in the matter, and it was then decided that something should be done to secure schools of this kind in the manufacturing districts of the state. The idea is that children who learn a trade in these schools will be much better fitted when they arrive at maturity for taking care of themselves and those who may be dependent upon them than if they are initiated into the work in the usual way and become a part of the machinery of a shop. They will become skilled in the all-round work and will have ideas of their own which they do not get when set at piece work, where they become adept in one thing and do not know much about anything else. The Ohio State University at Columbus, Case School of Applied Science at Cleveland, the Municipal University at Cincinnati and the Young Men's Christian Association are doing much to advance the higher education in the various branches of engineering, but it is contended that those who expect to become workmen would be much better fitted for their duties with a training of several years in an industrial school where they will be taught the principles of mechanics and a way opened up to them to think for themselves.

Promotion of Industrial Education.

At the convention of the National Society for the Promotion of Industrial Education, held at Chicago, on Jan. 23, 24 and 25, many interesting papers were presented. Brief abstracts of many of these papers are given below.

Mr. Theodore W. Robinson, chairman of the Illinois state committee, who acted as toastmaster at the opening banquet, announced that in 39 states committees have been organized for promoting industrial education, legislation upon this subject has been inaugurated by the states of Massachusetts and Wisconsin, while a bill has been introduced in Congress bearing upon this matter.

Dr. Chas. W. Eliot, president of Harvard University, stated that the remedy for the defects in our educational system is to have industrial schools for children between the ages of 14 and 18. The law must assist in getting the children into the schools. The teachers in the elementary schools should assist in determining the vocation which may be best chosen by the individual. "Nothing in our country is now done as it was done 50 years ago. We must guide the child into that path of life in which he may be most successful. We used to set children to doing all the things they could not do well. Now, we must seek out what the child can do best."

Mr. James W. Van Cleave, president of the National Association of Manufacturers, said that with only 5 per cent of the world's population, the United States furnishes 35 per cent of the world's manufactures. However, although our educational system makes ample provision for the professions, extremely little attention is paid to those entering upon industrial pursuits.

Dr. Henry S. Pritchett, president of the National Society for the Promotion of Industrial Education, stated that the experience of other nations shows clearly that a system of industrial training must sooner or later be grafted on to the general system of education, so that the boy of 12 may begin his preparation in the lower school. We may well expect that private initiative will lead the way by the erection of model school buildings for the various trades and callings which our industrial system demands.

Hon. Carroll D. Wright, president of Clark College, who presided at the meeting held during the forenoon of Jan. 24, remarked that the industrial revolution of the latter part of the nineteenth century resulted in the introduction of labor-saving machinery and was the beginning of the decline of the apprenticeship system. The apprenticeship system did not answer the whole demand for industrial education; neither does the industrial school furnish everything in the way of vocational equipment that can be gained by a thorough apprenticeship

system. What is needed is an enlightened coördinated system. The modern idea is to perfect the apprentice in the theory and to a large extent the practice of his trade in the shortest possible time commensurate with efficiency and skill.

Mr. J. F. Deems, general superintendent of motive power for the New York Central lines, stated that the immediate and direct results of an apprentice system inaugurated on the New York Central lines on March 6, 1906, have been: Increased output (notwithstanding the four hours per week spent in class), less spoiled work, ability to read drawings, to lay out templates and to make sketches, a better grade of apprentices, increased interest in the work, suggestions as to improved methods and tools, draftsmen for company drafting rooms and apprentices for special work as needed. The officials of the railroad are already enthusiastic over the results obtained in these courses.

Dr. Leslie W. Miller, director of the Pennsylvania Museum and School of Industrial Art, at Philadelphia, expressed some doubt whether much good is to be reasonably expected from trade instruction in schools unless some definite connection with the practical work outside the school is assured before the work of instruction has gone very far.

Dr. Victor C. Alderson, president of the Colorado School of Mines, contended that the establishment of trade, industrial and engineering schools is simply the application of science in a broad, comprehensive and intelligent way to the needs of industry, and said that that nation will be the most successful, industrially and economically, which makes the best use of science as an aid to industry.

Mr. Chas. F. Perry, director of the Milwaukee School of Trades, claimed that in the present curriculum there is a lack of studies that interest and hold pupils, and as a result 96 per cent of those who enter the primary grades fail to graduate from the high school. The inherent unrest of the adolescent period leads to a repulsion for abstract book work. The boy should be led to the theoretical side of his work through the practical.

Mr. Milton P. Higgins, president of the Norton Companies, said that the trade school is for the boy who must, from choice or necessity, get about life's work early. It should take the boy after he leaves the ninth grade of the public school. A trade school properly conducted will turn out a class of skilled workmen and will raise, not lower, the standards of workmanship, and will increase wages through superior skill and mechanical intelligence.

Prof. Graham Taylor, director of the Chicago Institute of Social Service, remarked that trade schools cannot fail to promote the special interests of the whole people. In the curriculum of the trade schools there should be included, both for the sake of the employer and the employee, instruction in the history, psychology and ethics of industrial relationship.

Mr. Luke Grant, in discussing the attitude of the wage earner towards industrial education, said that while the wage earner has no aversion to trade schools that are properly conducted, he does treat with contempt such a school that advertises that it will teach a boy the plumber's trade in six months and guarantees that he will be a competent workman. The best way to abolish the bad trade schools, which are known to exist for private profit, is to establish good trade schools, conducted under the supervision of educational boards, for the benefit of the youth of our country.

Rapid Automatic Telegraphy.

In a paper read before the Franklin Institute, on Jan. 15, Mr. Patrick B. Delany stated that, although the e. m. f. of circuits for transmitting electrical energy has increased from a few hundred volts to 75,000 volts within the last 20 years, the rate of transfer of words by telegraph has fallen off during the same period, and is now about one-fortieth of what a wire is able to convey. Previous to a few years ago there was strong opposition on the part of telegraph companies to the preparation of messages on tapes preliminary to their transmission, but it is now conceded that in no other way can the speed of a circuit be appreciably increased, and the perforated tape is coming into use even for unimportant advances in telegraphy.

In an electromagnetic automatic system, specifically described in the paper, use is made of an ordinary Morse key for operating a perforator. Four operators may be employed in perforating tapes by Morse keys at a total rate of 100 words per minute, and the product of their united work sent through a mechanical transmitter and reproduced on a perforated tape at the distant station. This tape is then distributed among four local circuits, where a perfect reproduction of the original characters are ticked off on the sounder and copied on a typewriting machine by the operator, just as if the characters were coming over the wire directly from the operator's key. If the system were duplexed, it would yield 200 words per minute in perfect Morse signals, and without the slightest deviation from the regular Morse method, the sender working his key, and the receiver copying by sound, while the message capacity of the duplexed wire would be increased from about 40 words per minute to 200.

In the rapid automatic telegraph system, means are employed for overcoming the effects of static discharge, so that a rate of 1000 words per minute is obtained. The static effect is neutralized by using reverse impulses after each signal. A rate of 1000 words per minute over a single wire requires 82 persons, 40 perforating machines for transmission, 40 transcribing them by typewriters, and two tending machines.

Mr. Delany said that at a rate of from 500 to 1000 words per minute per circuit, the charges can be lowered to a point such as to compete with the ordinary postoffice service. When a letter of 50 words filed in an office in Philadelphia can be dropped in the postoffice in Chicago or any other city within half an hour for 25 cents, an enormous traffic will be speedily developed.

It will be entirely feasible for business houses or newspaper correspondents to compose their letters or reports on tapes in their own offices by keyboard machines, send the tapes in rolls to an office, where it will be forwarded without delay, and have the record tapes delivered at the other end, for private transcription. In this way correspondence would be absolutely private, for, if desired, the perforated tapes could be returned to the senders.

Hydro-Electric Plant for Tokio, Japan.

The first 60,000-volt hydro-electric plant in Japan has just been put into service after having passed the rigid inspection which is required by the Japanese Government of all electrical installations. Power is obtained by impounding the Ugigawa, a narrow and swift but deep river, such as is often found in the mountainous portions of Japan. The normal rating of the main station, which is 18,000 kilowatts, is furnished by six 3000-kw, 50-cycle, 6600-volt water-wheel-driven alternators. The generator voltage is stepped up to the line e. m. f. of 60,000 volts through three banks of three single-phase, water-cooled, 2000-kw transformers, at which potential energy is transmitted 25 miles to the Waseda sub-station just outside the city of Tokio.

In this main sub-station water-cooled, 1800-kw transformers decrease the e. m. f. to 11,000 volts, at which potential energy is transmitted underground through lead-armored cables to 11 distributing sub-stations situated in various parts of the city. In each of these smaller sub-stations oil-cooled transformers of 250-kw rating reduce the e. m. f. to 2000 volts, the line potential of the city circuits.

The territory immediately surrounding the Waseda sub-station is also fed with energy at low voltage for lamps and motors. The transformer, regulating and control equipment, and the cables were furnished by the General Electric Company.

Telephonic Development in Spain.

United States Consul-General B. H. Ridgely, of Barcelona, advises that a royal order has been published in the Spanish Official Gazette inviting tenders from native firms for the installation of a large and important telephone system connecting with the French wires at the frontier towns of Irun and Portbou.

The line will start from Madrid and at Zaragoza branch off in two directions, one passing through Pamplona, Tolosa, and San Sebastian to Irun, and the other following the line through Lerida to Barcelona and Tarragona, and thence on through Gerona to Portbou on the French frontier, thus establishing communication betwen Barcelona and France. Stations will be placed at all the towns named above. The work will have to be commenced before July, 1908, and terminated within the year.

Tenders are also solicited for the construction and working of telephone systems connecting Madrid with Coruña and Ferrol, with Pontevedra by way of Orense and Vigo, on to Gijon, Santander and several other smaller towns. This will be known as the Northwestern System. Another, the Southeastern System, will connect Madrid with Cartagena, Albacete, Alicante and Murcia, Almeria, Lorca, Linares, Jaen, Granada, Baza and Motril. Another system, to be known as the Southern Telephone System, will link up Madrid with Cadiz, Seville and Jerez; with Malaga, and with Huelva, Badajoz and Zafra.

Inasmuch as only native firms are invited to compete for these contracts their interest for American exporters lies in the fact that large orders will naturally be given by the contractors for wire, posts, insulators and other material as soon as the contracts are finally signed, which it is expected will be in January. Now, the telephone companies of Spain buy their wires mainly in Germany and their apparatus in Paris and Stockholm.

CURRENT NEWS AND NOTES.

CHINA IN THE TELEGRAPH CONFERENCE.—A dispatch from Peking announces that China has appointed delegates to represent her, for the first time in her history, at the next International Telegraph Conference.

BELGIAN INTERNATIONAL EXPOSITION.—An international electrical exposition will be held at Brussels, Belgium, in 1910, beginning in April and remaining open for at least six months. One of the features will be the installation of exhibits by national sections.

BROOKLYN DEATH ROLL.—Last year 102 persons were killed by trolley in Brooklyn, N. Y., 26 were killed on the elevated electric railroads, and 6 were killed by live wires, while 83 were accidentally suffocated by gas, and 4 were "killed" by the same medium. The trolley victims were nearly all young children playing carelessly in the street.

HIGH TELEPHONE POLE.—A Seattle, Wash., paper mentions a telephone pole in Aberdeen 190 ft. high, which is claimed to be the highest one-piece pole in the world. It is a fir sapling and measures 18 ins. at the base and 5 ins. at the top. It supports wires over the harbor, at a sufficient height to permit the passage of sailing vessels.

THE SOUTHWESTERN QUESTION BOX.—Mr. Samuel Kahn, of the San Antonio Gas & Electric Company, editor of the Southwestern Electrical & Gas Association Question Box for 1908, is sending out invitations for questions for the next convention question box. The convention is to be held at El Paso, Tex., in May.

LIGHTNING EFFECT ON CHIMNEY.—Recently the high chimney of the power house of the New Jersey Training School for Feeble Minded Children was struck by lightning, and a superficial layer of brick work torn from the surface to a width of one or two feet, from within a few feet of the top to where the iron boiler flue enters the chimney at the bottom. The trace of the discharge is a wavy one, confined almost entirely to one side of the chimney.

FALLING SIGNS.—Electric signs in New York City and vicinity suffered considerably from the recent high winds. A 40-ft. section of an electric sign 6 ft. high at Forty-second Street and Sixth Avenue was torn from its fastenings and injured four persons as it fell to the street. At Coney Island an electric sign 3 ft. x 20 ft., suspended in front of the Deluge Building in Surf Avenue, was blown down. Several passers-by were struck by flying pieces, but no one was seriously injured.

ELECTRIC POWER DEVELOPMENT IN INDIA.—It is reported that an American syndicate has taken the contract for the construction of a fleet of dredges for deepening the Jhelum River, flowing through the Cashmere Valley of India, the contract involving an outlay of $10,000,000. For the purpose of generating electrical energy to operate the dredging plant and also to supply electric power to a 200-mile railroad to be built, a plant initially equipped with 200 horse-power of American machinery is to be installed. It is stated that Mr. L. A. Dosy, who is in charge of the St. Lawrence River dredging work, will have supervision of the work of dredging in India.

WASHINGTON POWER PLANT.—It is announced that the Pacific Coast Power Company, recently organized by the Stone & Webster interests, will erect at the foot of Lake Tappe, in Pierce County, Wash., west of Spokane, at the cost of $10,000,000, an electric power plant having ultimately a capacity of 100,000 horse-power. The plant will be developed to 50,000 horse-power at first, and subsequently increased to its maximum capacity, in accordance with the demand for power. Current will be supplied from this plant for the interurban system which will unite the cities of Bellingham, Everett, Seattle, Tacoma, Elma, Aberdeen and Portland, Ore.

OHIO TELEPHONE REGULATION.—Representative Earl Stewart has prepared a bill to be introduced in the Ohio State Legislature which will place the telephone business under the state railroad commission with plenary powers. Schedules of rates must be filed with the commission, if this bill passes, and where rates are considered unreasonable, new rates may be fixed. An air-line charge per mile must be made for all long-distance business within the state, and interchange rates and business are subject to revision by the commission. When the Council of any city or village refuses or neglects to fix terms and conditions under which a company may use the streets and alleys for telephone purposes for 100 days, then the commission may take the matter up and fix such terms and conditions. The commission will thus have power to grant franchises. This bill is considered almost as revolutionary in its nature as the recently introduced public utilities bill that applies to railroads and traction lines.

NEW YORK STATE WATER POWERS.—The annual report of the State Water Supply Commission estimates that at present the rivers of New York State, excluding Niagara and the St. Lawrence, are capable of furnishing at least one million horse-power for industrial purposes, and that at present more than one-half of this is unutilized, because no plan for the development of its water powers has yet been undertaken by the State. Reference in detail is made to water powers of the Sacandaga, Genesee and Raquette Rivers. In the case of the first mentioned, it is stated that a dam can be built in the foothills of the Adirondacks that will render available 50,000 horse-power, and would increase the present available water power at sites lower down the Hudson by 70,000 horse-power during the six dry months of the year. A dam on the Genesee River at Portageville would render available 32,000 horse-power and increase by 14,000 horse-power the horse-power now developed in the vicinity of Rochester.

NATIONALITY OF EMPLOYEES.—In one of the bills before the New York State Assembly it is provided that no corporation regulated by the Public Service Commissions shall hereafter employ any person who is not a citizen of the United States; and that violation of the law should constitute a misdemeanor.

SAPPHIRES BY ELECTRICITY.—It is noted from Paris that Eugène Maret, the French engineer, has established an electrical furnace with which he says he will be able to manufacture several pounds of sapphires daily. These artificial stones will be harder than the natural gems, and can be graded to any shade desired. The raw material used is Roman alum and chromatic acid.

TELEGRAPHIC BREVITY.—Some recent notes from Europe remark that the word "Eisenbahnbetriebstelegraphen-inspektionsassistenten" would suggest German humor were it not recognized in the census of all the professions, trades and occupations which were covered in the German Empire in June last. The calling in question is that of assistant inspector in the railway telegraph service, and is one of 15,016 different occupations specialized by the census taken in that month.

ELECTRIFICATION OF CHILEAN RAILROADS.—Consul Winslow, of Valparaiso, Chile, reports that the Chilean government is considering the subject of substituting steam for electricity for the operation of the section of the State Railroad extending from Santiago to Concepcion, a distance of 350 miles. Mr. Walter T. Peck has been commissioned by the Chilean government to prepare a report on the results attained in this country by the substitution of electricity for steam in railroad service.

OHIO MUNICIPAL PLANTS.—Attorney General Wade H. Ellis has expressed the opinion that Ohio municipal electric light plants have the authority to sell current to private consumers under a law which he aided in framing some years ago. He says that the Longworth amendment did not change the law, but merely made it plain that natural gas plants may be established by municipalities also. The point is involved in a case now before the Supreme Court, that of Nelsonville, and should this be adverse to the opinion expressed by the attorney general, it is claimed that then an amendment will be made to the law, as it is believed the general assembly will enact such an amendment without opposition.

STEVENS ALUMNI DINNER.—The seventh annual dinner of the Alumni of Stevens Institute was held at the Hotel Astor, New York, on Tuesday evening, Feb. 4. About 250 Stevens men and their friends were present, and besides enjoying the usual features of a college dinner and reunion, they heard some notable addresses, among the speakers being President Alex. C. Humphreys; Dr. H. S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching; Hon. Robert P. Porter, formerly chief of the Census Bureau and now the American representative of *The Times*, of London; Colonel George Harvey; James E. Sague, of the New York Public Service Commission; Colonel Charles W. Fuller; Prof. George V. Wendell; Ernest H. Peabody and H. V. R. Scheel.

INDUSTRIAL EDUCATION.—Prof. Alexander C. Humphreys at the annual dinner of the Alumni of the Stevens Institute of Technology, held on Feb. 4, in referring to the attack by Mr. R. T. Crane on Carnegie's endowment for technical education, said that he was prepared to go a short distance along the road Mr. Crane has taken, for in his work he would prefer as a subordinate the man with a technological scholarship of 30 and an outside experience of 90 rather than the reverse. He advocated the inclusion in a technical curricula of a thoroughly practical course in economics of administration, in order that the student before graduation should be better prepared to meet the political and economic questions of the day as involved in the problems of engineering and industrial administration. He recommended the further development of the Stevens course in the business features of engineering, and urged the alumni to bring this matter to the attention of men of surplus wealth throughout the United States, that the means might be provided to enable the institute to take the lead in this direction.

THE NINE-HOUR DAY FOR RAILWAY TELEGRAPHERS.—The law, which will become effective March 4, prescribing a nine-hour day for railroad telegraphers, was the subject of discussion at a meeting at Washington a few days ago between members of the Interstate Commerce Commission and representatives of nine trunk-line railway systems. The latter informed the commission that the railroads were unable to render a strict compliance with the law, inasmuch as its requirement of a nine-hour day would necessitate the employment of 15,000 additional men. They represented that it was impossible to secure an army of men of the class desired upon short or long notice. The commission was asked, therefore, to request Congress to make such a change in the law as to meet present conditions. The commission takes the ground that it has no discretion in the enforcement of the law. Nor can it extend relief to the railroads in the present emergency, inasmuch as the law can be waived only after hearing in particular cases.

FORESTS AND WATER POWER.—At Washington on Jan. 30 governors and their representatives, other state officials, federal experts, presidents of commercial and civil associations and officers and members of a dozen forestry bodies, numbering nearly 200 and representing all the states east of the Mississippi River, except Florida, Illinois, Indiana and Mississippi, appeared as a special forestry delegation before the House Committee on Agriculture. The American Institute of Electrical Engineers also participated. Under the leadership of Governor Hoke Smith, of Georgia, the delegation made an exceptionally forceful showing of facts and figures in support of the Currier bill, appropriating $5,000,000 for the purchase of about 7,000,000 acres of mountain lands in the Appalachian and White Mountains, to be held as national forest reserves for the conservation and control of the navigable and power-producing streams of the states affected. The minimum horse-power of the Southern Appalachian streams is put at 2,740,700 horse-power for the year, and the minimum for six high-water months at 4,929,573 horse-power. The Geological Survey estimates that at least 50 per cent of the minimum is available for development.

ENGINEERING AS A LIFE WORK.—Prof. Henry H. Norris, of Cornell University, delivered an address before the students of Purdue University, Jan. 27, having for its subject "Engineering as a Life Work." He directed particular attention to the personal qualities necessary for success in an engineering career. Among these is the ability and desire to accept responsibility, and the qualities of leadership, elements of which are thoroughness and the faculty for seeing the interrelations of things and thoughts. Drawing a distinction between wage-earners and salaried employees, he pointed out that the first puts his skill, the second himself into his work; the first is paid for his labor, the second for his interest; the first is paid for overtime, while there is no overtime for the second; the pay of the first is regulated by unions, while the second is theoretically paid a reasonable living salary in accordance with the expenses to which his position subjects him; good work on the part of the wage-earners is usually recognized as results are evident, but this is not always so in the other case, as the true leader loses himself in his work. Professor Norris directed attention to the following qualifications which some technical graduates do not possess, and asked his auditors to question themselves as to their possession: Answer business letters by return mail; write a clear, brief report or letter; defend their own opinions; reason from premises to a conclusion; realize the obligation involved in a contract; inspire others to their best efforts.

ILLUMINATING ENGINEERING.—The New York section of the Illuminating Engineering Society will meet in the Engineering Building on Feb. 13 when Mr. George Leland Hunter will present a paper on "Light and Color in Decoration" with lantern slides in color. He is an authority on decoration and tapestries.

JIM CROW TELEPHONES are proposed in Oklahoma, whose new constitution is the most progressive, advanced, liberal document on earth. All telephone exchanges are required by the proposed law to have separate waiting rooms and separate telephone booths for whites and negroes, in "first-class" cities. It would appear that the offence of being black does not count in cities of lower degree.

WRECK OF "TECHNOLEXICON."—As recently announced in these columns, the German Society of Engineers has abandoned the proposed publication of the "Technolexicon," an international technical dictionary. It now appears that more than $100,000 had been spent on the work, and liabilities of $20,000 in addition will have to be discharged by the society. Work has proceeded during the past five years, and it was estimated that for completion at least 10 or 12 years additional would be required, with further great outlays of money. Anyone having had experience with this class of work can easily realize how, if not subject to strict commercial supervision, the cost can easily pass all bounds.

METRIC SYSTEM FOR DENMARK.—According to a law passed by the Danish Rigsdag, the use of the metric system is made compulsory for all government purposes not later than May 4, 1910, the date of adoption prior to the limiting date to be fixed by the king; and two years after this adoption the system is made compulsory throughout the kingdom for all purposes, with an exception in favor of apothecaries' weights and measures and scales for weighing precious stones. The exception in favor of apothecaries' use is doubtless made to provide for the compounding of older formulas, as physicians in Denmark now employ generally the metric system in writing prescriptions. In the U. S. naval service medical officers have for many years used the metric system for this purpose.

MANICURING NIAGARA.—It is stated from Washington that a plan for the preservation of the scenic beauty of Niagara Falls by the creation of the national or international reservation bordering Niagara from the rapids to the end of the gorge below the falls has been presented to President Roosevelt by the officers of the American Civic Federation. With the plan carried out the river would be lined on either side by a grove of trees, and all power plants and factories moved to the background. The plan contemplates the renewal of the Burton act for a period of ten years. This act limits the amount of electricity which may be generated by a diversion of the waters of the river. The "moving" of the power plants seems to be treated by the Federation in a spirit of levity.

ITHACA BRANCH A. I. E. E.—Before and after the Christmas vacation two special meetings of the Ithaca branch of the A. I. E. E. were held. At the first Prof. W. D. Bancroft, head of the Department of Physical Chemistry, Cornell University, delivered an illustrated talk on "The Electro-Metallurgy of Steel." The speaker gave details of the latest types of furnace used in the manufacture of steel, and gave comparisons of the cost of producing steel in this way, and by means of the converter and open-hearth processes. At the second meeting local members abstracted the papers on "The Mechanical Engineering of Power Stations," delivered in New York in December. The discussion was especially interesting to local members, as all of the students in Sibley College go through a series of elaborate mechanical engineering tests, covering many of the principles laid down in these papers. There are 127 members, associates and enrolled students in the local branch at this date.

PATENTS IN 1907.—The report of the Commissioner of Patents for the fiscal year ending June 30, 1907, has been issued. During the year there was filed a total of 66,795 applications, including 56,514 for mechanical patents; 816 for designs; 192 for reissues; 7869 for registration of trade-marks; 982 for registration of labels, and 422 for registration of prints. In addition to these applications, there were filed 1900 caveats. There were issued 33,644 mechanical patents; 529 design patents; 165 reissues; and there were registered 8798 trade-marks; 660 labels, and 325 prints. The number of patents which expired was 25,322, while 4707 letters patent were withheld for non-payment of the final fees; 14,565 applications were allowed, and awaiting the payment of the final fees. The total receipts of the office from all sources amounted to $1,859,592.89 for the fiscal year, of which there were expended $1,584,489.70, including $932,665.59 for salaries, leaving a surplus of $275,103.19, turned into the United States Treasury. The total net surplus of receipts over expenditures in the Treasury to the credit of the Patent Office on Jan. 1, 1908, was $6,706,181.64, an amount derived entirely from the fees paid since 1837. At the end of 1907 no fewer than 18,540 applications awaited examination. An increase of force and facilities is badly needed.

A COLLEGE INNOVATION.—A novel departure is noted in the fact that the post-graduate students in electrical engineering taking the course in electrical engineering practice at Worcester, Mass., have organized the Worcester Polytechnic Institute Graduate Engineering Company, doing a general consulting engineering business, with the members of the electrical engineering department as clients. The class of problems with which they have to deal is very much the same as those they would meet in a consulting engineer's office, including, for example, a report on a proposed power development scheme; a report on the cost of power in a given plant where an opportunity for making tests for efficiency and economy of operation is given, and where free access to the records is permitted; and laying out an express schedule for an interurban electric road. These problems are designed to make the student more thoroughly familiar with various matters taken up in preceding courses; and being entirely practical, and carried out in this way, are much more interesting than the sort of examples sometimes given. The office is completely organized with chief and assistant engineers, and will carry on things in a business-like way, all intercourse with clients (members of the electrical engineering department) being carried on by correspondence or by special appointment.

MAIMING OF TREES.—In a recent issue, on the subject of tree lopping for aerial wires, the *New York Tribune* said: "More power and yet again more power to the already puissant elbows of the municipal authorities of Plainfield, N. J., and to those of all similarly disposed public servants. The other day four telephone linemen were observed to be slashing and mutilating shade trees along the street, according to the habits of their tribe, to make room for the easy stringing of overhead wires. At the instance of the Shade Tree Commission the police arrested them. They protested that they had a right to do as they had been doing, and showed as evidence thereof permits from the adjoining property owners to cut the trees. The chief of police declined to recognize the permits as valid and took the men to court, where the judge also ignored the permits and fined the prisoners. The principle thus established is a good one. Nobody has a right to mutilate a tree without the consent of the owner of it or of the property before which it stands. But neither has the owner of the property before which it stands the power to authorize its destruction or mutilation. It is true that he may have title to the street to its center, or its whole width if he owns on both sides, but it is perfectly obvious that he cannot do with the trees as he wills, so as to obstruct the street or to impair the rights of public usage on it. Neither can be do as he wills with the shade trees which are growing along it for general public enjoyment."

ASBESTOS SLATE.—According to German publications, a firm in Munich has succeeded in rendering asbestos waterproof and is putting it on the market in the form of asbestos slates which can be used in construction without wooden laths being necessary. The slates are said to be valuable as insulation for various kinds of electrical work.

TOKIO TROLLEYS.—U. S. Consul-General Henry B. Miller, of Yokohama, advises that the municipalization of the Tokio City Electric Railway has been agreed upon, the price being $38,750,000 gold, to be paid in municipal bonds bearing 6 per cent interest, and redeemed in installments within 27 years. The line will be transferred on March 31.

INSTITUTE MEMBERSHIP.—The Toronto, Can., section of the American Institute of Electrical Engineers is agitating the question of a subdivision of the class of Associates into two classes, namely, "Associate Members" and "Associates," to the former of which groups engineers alone could be admitted. The object is to have the institute council appoint a representative committee to investigate the question and redraft the specific article in the constitution regulating the matter.

GAS ENGINES.—The first meeting of the gas power section of the American Society of Mechanical Engineers will be held Tuesday evening, Feb. 11, in the Engineering Societies Building at 29 West Thirty-ninth Street, New York. The subjects under discussion will be "Experimental Gas Turbines in France" (with lantern slides), "A Simple Continuous Gas Calorimeter," "A Gas Engine and Producer Guarantee." Other subjects relating to the question of gas power will also be discussed.

MINING ENGINEERS.—The ninety-fourth meeting of the American Institute of Mining Engineers will be held in New York City, beginning Thursday evening, Feb. 18. The institute headquarters will be in the foyer of the United Engineering Societies Building during Wednesday and Thursday. At the opening session on Tuesday evening an illustrated paper on "Electric Power in Steel Mills" will be presented by Mr. David B. Rushmore, technical head of the mining department of the General Electric Company.

THE FALL ELECTRICAL SHOW.—Even this far in advance there is every indication that the second annual electrical show, which will be held at Madison Square Garden, New York City, Oct. 3-14, will surpass the exhibition of last year. Mr. George F. Parker, the president, announces that 60 per cent of last year's exhibitors already have re-engaged the space they occupied before. Among the exhibits will be the wireless telephone and it is hoped that arrangements can be made to bring over a gyroscopic train from England.

ELECTRIC HEATING IN SHANGHAI.—It is stated by United States Consul W. T. Gracey, of Tsingtan, China, that electrical kettles for afternoon tea are finding a sale in Shanghai; also electrical radiators in plain and ornamental styles, which are most useful in Shanghai during the damp weather, when a small and steady fire is needed for drying clothing, etc. The Shanghai municipal electrical department has a special low rate of charge for these heating appliances, and they are now being used in residences and offices to good effect.

VIENNA MUNICIPAL LOANS are rather staggering in their size, and Dr. Carl Lueger, the burgomaster, has a new one of $75,000,000. Electric lighting will absorb $17,500,000; gas, $6,250,000; tramways, $12,500,000; the municipal brewery, $500,000; and cemetery, markets, municipal coal yards and municipal undertaking of funerals yet another $7,500,000. In the improvement of the city by the demolition of old buildings and the laying out of parks and gardens, the erection of a technical museum, workhouses, asylums, a jubilee hospital and additional water service another $25,000,000 or $30,000,000 will be laid out.

JAPANESE EXHIBITION.—An international exhibition is to be held at Tokio in 1912, under governmental auspices and control, where it is hoped that the United States, with its large and growing interests in Japan, will be well represented. The site will include the Aoyama parade ground adjacent to the imperial estate, and will be about 292 acres in extent. There will be five departments—science, education, machinery, electricity and manufactured articles. For the installation of such exhibits, space will be allotted in the buildings erected by the administration, but special exhibit buildings may also be put up. Provision will be made by law as to exemption from duties, and for copyright protection.

CHICAGO ELECTRICAL SHOW FOR 1909.—Manager Homer E. Niesz, of the Electrical Trades Exposition Company, Chicago, is already sending out application blanks for space at the 1909 Chicago Electrical Show, to be held at the Coliseum, Chicago, Jan. 11 to 23. The same arrangement as regards erection of booths for exhibitors is to be made for 1909 that was so successfully and satisfactorily carried out in 1908. The exposition company did all the work of erecting booths and supplying furniture, thus relieving the exhibitors of an immense amount of exasperating detail work, as well as troubles from strikes, extortionate charges and a multitude of evils that accompany an exhibition of this kind where every exhibitor has to make his own arrangements as to booth erection and electrical wiring.

THE WIRELESS TREATY.—It is stated from Washington that the Republican members of the Senate have reached a virtual agreement to take no action relative to the wireless telegraphy treaty which has been pending before the Committee on Foreign Relations since almost the first day of the session. This conclusion is in spite of the fact that a dozen or more great powers have already approved the treaty and are now waiting for the co-operation of the United States. It is purposed to let the wireless treaty remain in the committee indefinitely while the Navy Department watches the behavior of the wireless companies. If they refuse to transmit distress signals or to show reasonable co-operation the treaty will be taken from its pigeon hole and ratified. The passage of the treaty would place all companies under international supervision.

ELECTRIC LIGHT ACCOUNTING.—The accounting committee of the Empire State Gas & Electric Association has had a number of conferences with similar committees of National Electric Light Association, the American Gas Institute, the Street Railway Association and with the statisticians of the Public Service Commissions of both the first and second districts. A classification has been prepared by the committee, which in a large number of respects has met with the approval of the statisticians of the commissions. There are, however, still some important points which are being discussed before the final adoption by the commissions of a classification for use by all the companies of the State. An interesting point is the entire absence from the classifications proposed of the word "depreciation," which has been so much discussed and which has been used to cover so many different meanings. The fund generally designated by this word will be termed either "contingent expense" or more probably "amortization." It has been the continual aim of the committee to secure the adoption of some classification which would be simple enough for the smallest company, but which could be automatically expanded so as to also provide for the largest company. The operating accounts have been reduced to the lowest possible number, but even a few of these it may be possible for some companies to omit, thus making a still further reduction. The committee's conferences with the representatives of the commission have been of the pleasantest character, and the members are optimistic as to the classification which will be finally adopted.

Electrical Equipment of the New York Custom House.

By H. THURSTON OWENS.

A BUILDING which will rank among the monuments of this decade, if not this century, has recently been completed in what is destined to be the world's metropolis. It occupies a square block at the lower end of Broadway, New York, and is surrounded by the Produce Exchange on the west, business buildings on the south, Battery Park on the

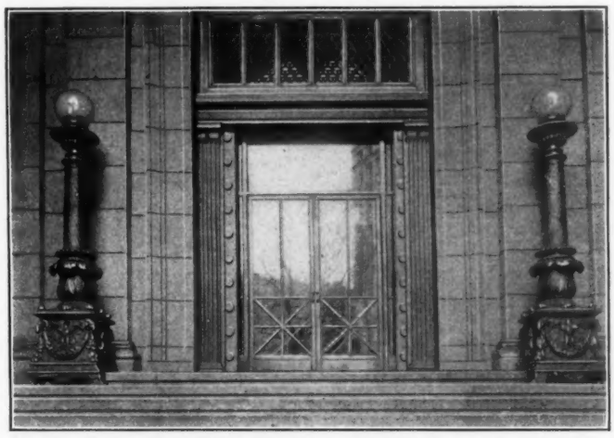


FIG. 1.—STANDARDS AT MAIN ENTRANCE.

east and Bowling Green on the north. Although it is in the neighborhood of the "skyscrapers," the site affords a vista in keeping with its imposing appearance.

The building is of classical architecture, cost over $7,000,000, and six years were required to complete it. The interior wiring is encased in conduit throughout, separate conduits being provided for lamp and motor circuits and for telephone, call-bell, time-detector and clock circuits. Special care was taken

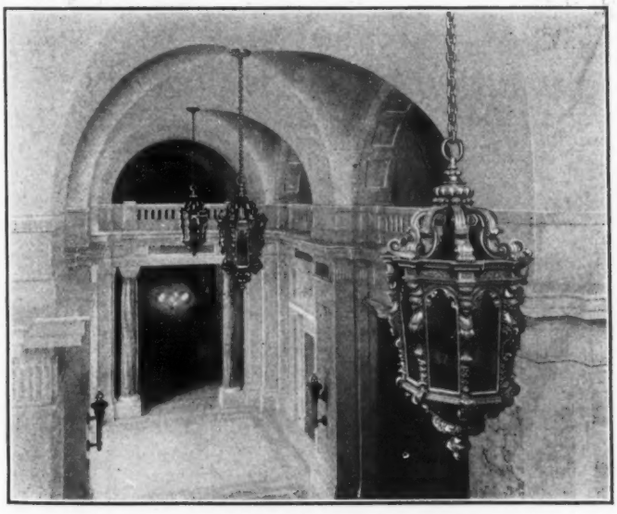


FIG. 2.—CORRIDOR AT MAIN ENTRANCE.

in the location of panel boards and outlet boxes, most of which were set in exact position by the aid of surveying instruments.

ILLUMINATION.

The broad stairway with the four colossal figures representing Europe, America, Asia and Africa, spell "monumental" and the building is that beyond a doubt. At the head of the stairs, at each side of the doorway, are two magnificent bronze standards, as shown in Fig. 1, and these clearly indicate the character of the equipment to be found within. Each standard has seven 16-cp clear lamps within the 14-in. frosted enclosing globe. These two fixtures cost over $5,000. Beyond this doorway is a short vestibule opening into the main corridor. To the front is the rotunda and at each end the stairways and elevators. A view of this corridor, taken from the mezzanine balcony which surrounds three sides, is shown in Fig. 2. The room is in marble of three colors, white background, brown panels and green columns. The lines are very simple and the only decorations are the beautiful bronze doorways, window-sashes and the lighting fixtures.

The lanterns are reproductions of an old Italian model, being made of carved wood, with sides of old Italian amber glass. They are very large, measuring 8 ft. over all, and are equipped with 24 16-cp clear lamps. In addition to these lanterns there are four massive brackets equipped with 13 16-cp round frosted lamps, one of which is shown in Fig. 3.

Six types of fixtures may be seen from the center of this corridor (see Figs. 2, 3, 4, 5 and 7), and in addition there is one

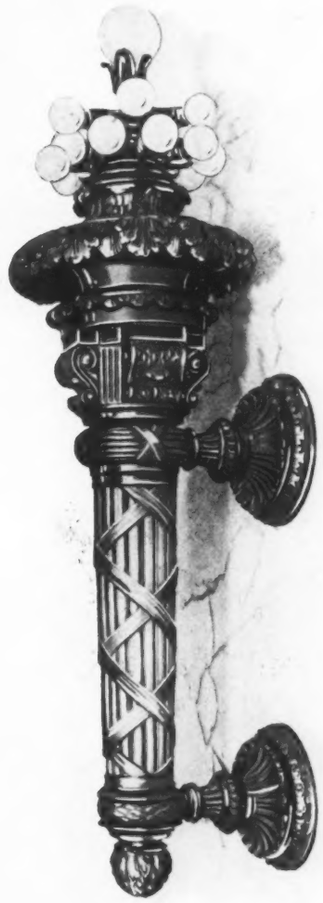


FIG. 3.—WALL BRACKET.

large beaded ball. In the adjoining vestibule are two bronze brackets, as shown in Fig. 5, these being equipped with six 16-cp lamps in a 12-in. frosted globe. In the foyer opposite the vestibule mentioned above are two bronze brackets similar in design to those shown in Fig. 7, but with 10-in. round frosted globes. Just why three styles of brackets are used, and of such massive size, is not apparent to the lay mind; and the equipment of those shown in Fig. 3 is entirely out of proportion to the size of the fixture. The beaded ball fixture in close proximity to the handsome lanterns seems particularly inappropriate.

At each end of the corridor, at the elevator entrances, are chandeliers of carved wood, as shown in Fig. 4. At the end of each of the six arms are 6-in. frosted globes enclosing one 16-cp lamp and in addition there are six 16-cp round frosted lamps clustered around the base. Just beyond are the stairways, and the fixture used is a carved wood ceiling cluster

similar to the one shown in Fig. 9. There are five 16-cp round frosted lamps on each cluster.

At the western end of the main corridor is the office of the Collector of the Port. The furnishings are sumptuous, as the

FIG. 4.—HALL CHANDELIER.

lighting fixtures clearly indicate, the design being the "horn of plenty." This design is synonymous with the political affluence associated with the title as well as representing the blessings of a successful government.

At the opposite end of the corridor is the cashier's office, shown in Fig. 6. The three bronze chandeliers each have

FIG. 5.—WALL BRACKET.

12 16-cp frosted ball lamps, and there are 16 brackets with five 8-cp frosted ball lamps, shown in Fig. 7. The location of the chandeliers, practically over the partition, is one of the few instances of the kind to be found in the building. They appear to be of sufficient strength to sustain a weight many times greater than that of the lamps, but they are beautiful examples of the bronze worker's art.

In the counting room or rotunda, in marble and white plaster, shown in Fig. 8, is a remarkable example of diffusing lighting, which is obtained by means of a double roof of glass, the panels shown in cut being plain glass, and above is a dome of prisms. The artificial light comes from a row of 110 16-cp clear lamps at the edge of the glass, and a row of 50 16-cp frosted lamps in the edge of the frieze.

The general interior of the building is lighted by 50-watt Gem lamps, of which there are upward of 3000 in use. Eighty per cent of the lamps have clear glass bulbs and twenty per cent have bulbs of frosted glass. The corridors of the basement and the first floor have frosted balls pendent on chains, as shown in Fig. 10, and are equipped with five 50-watt Gem lamps, pendent with nickel reflector. On the upper floors the same style of fixture is used, but equipped with one lamp with prismatic reflector. The reflectors mentioned in both cases are inside of the globes.

Light is provided upon the stairways at the landings, there being one landing between each floor. There are two lamps on each landing and a total of 50 lamps throughout the building.

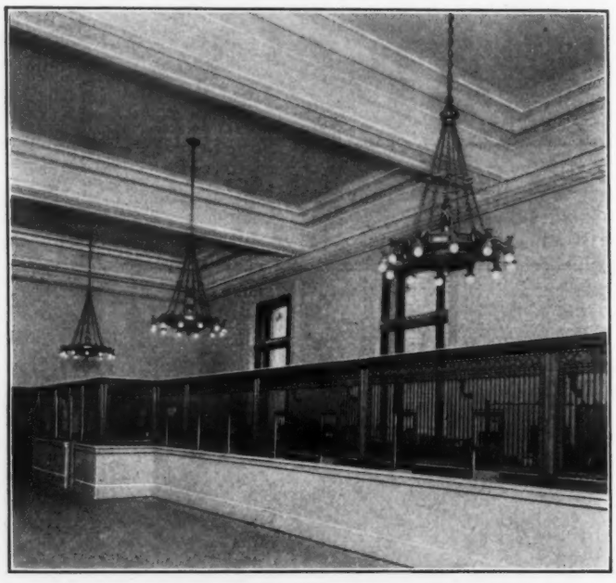


FIG. 6.—GENERAL VIEW OF CASHIER'S DEPARTMENT.

This pattern of lamp is shown in Fig. 7, the equipment in this case being two 16-cp lamps within a 10-in. frosted enclosing globe.

The post office department has a branch in the building and the lighting equipment is somewhat different to that of the general installation, the features being numerous types of lamps and reflectors where special lighting is necessary and the placing of the lamps in the chandeliers at an angle of 45 deg. The office of the Naval officer is finished in oak with beamed ceiling, and the fixtures, chandelier and brackets are of wrought iron.

The main corridor in the basement, as shown in Fig. 9, is finished in marble, and the lighting fixtures are principally for architectural adornment. There are 16 bronze standards equipped with eight 8-cp round frosted lamps and ceiling clusters in addition.

The general offices throughout the building have chandeliers which are simple in design, the lamps being pendent with holophane concentrating frosted reflectors. The chandeliers have four, six and eight arms and a corresponding number of lamps according to location and are placed from 9 ft. to 12 ft. above the floor. The result of placing the lamps at this unusual height is that the light is quite generally distributed without bad shadows from desks and furniture, but is only sufficient for general illumination.

Individual desk lamps are therefore provided, the equipment consisting of 50-watt Gem lamps and adjustable brackets with tin reflectors, green outside and aluminum inside. In the bookkeeping departments the local lighting is provided by

FIG. 7.—BRACKET FOR STAIRWAY LANDINGS.

means of stationary fixtures with lamps pendent, and conical shades.

Some of the rooms on the first floor have lamps enclosed in spheres instead of being equipped with reflectors. The spheres

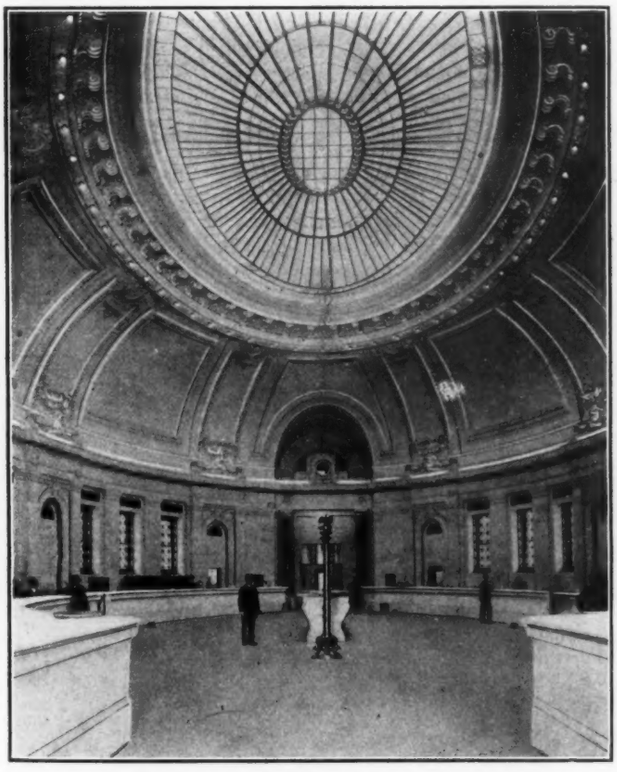


FIG. 8.—GENERAL VIEW OF COUNTING ROOM.

have lower halves of frosted glass, the upper halves being of prismatic glass.

The corridors from the third to the seventh floor are lighted by 40-cp, 75-cp and 100-cp Westinghouse metallized filament lamps, the lower halves of the lamp bulbs being sandblasted. The corridors on the Bowling Green side of the building from the basement to the third floor are lighted by Jaeger 8-cp, 16-cp and 50-cp tipless lamps.

The lighting equipment includes comparatively few fixtures

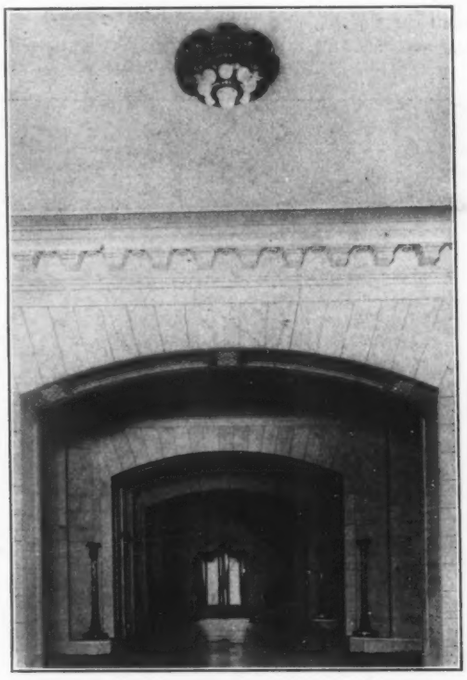


FIG. 9.—LOWER CORRIDOR ON BOWLING GREEN SIDE.

of purely ornamental value, the location of the fixtures being generally in keeping with the office furnishing. Desk lamps are plentifully provided, so that good illumination obtains.

MECHANICAL EQUIPMENT.

The electrical energy for the entire building is obtained from the mains of the New York Edison Company. There are two

FIG 10.—LOWER CORRIDOR ON BRIDGE STREET SIDE.

service connections provided, one from State Street and the other from Whitehall Street. Both are brought to the main service board consisting of four panels and are there divided into two motor feeders and two lamp feeders. The energy is metered by two 1200-amp. watt-hour meters and four 450-amp.

watt-hour meters, the former on the motor circuits which are two-wire and the latter on the lamp circuits which are three-wire. From the main service board the feeders lead to two distributing switchboards, shown in Fig. 11, the board on the right controlling the motor circuits and that on the left the lamp circuits. The motor switchboard is equipped with fuses and circuit-breakers and the lamp switchboard is fitted with fuses and switches. There are eighteen feeders for the lamp

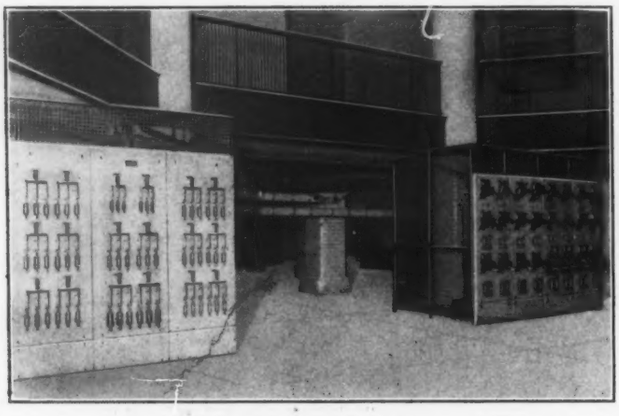


FIG. 11.—SWITCHBOARDS FOR LAMP AND MOTOR FEEDERS.

circuits and each motor receives energy from an individual circuit. The motors are all designed for operation on 225 volts.

Because of the size of the building the heating and ventilating system is separated into four independent divisions, each serving a section of the building adjacent to one corner. Each

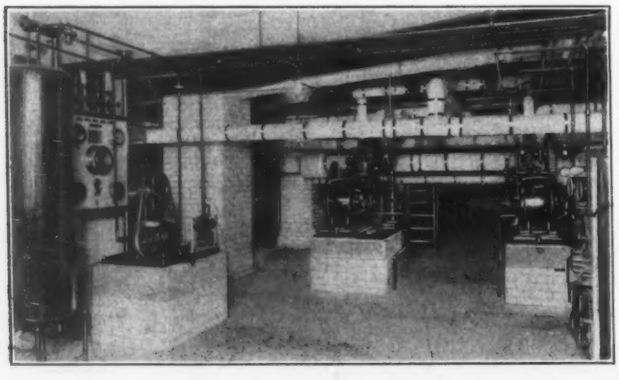


FIG. 12.—THERMOSTAT CONTROLLER AND HOUSE PUMPS.

division has an independent blower driven by a 40-hp motor. The air is washed and reheated before being delivered into the heating ducts and the air-washing apparatus is fed with water by two centrifugal pumps each of which is direct connected to a 5-hp motor. The water of condensation from the heating coils is fed back to the boilers by two triplex pumps

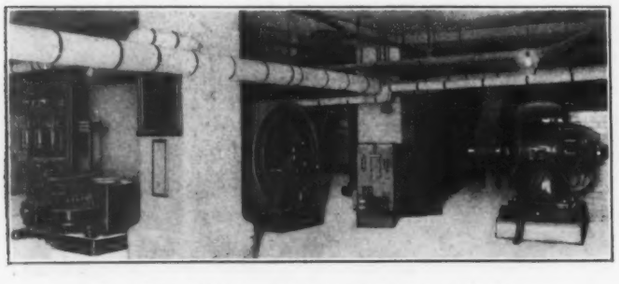


FIG. 13.—ELEVATOR AND VENTILATING MOTORS.

driven through silent chain gear by 7½-hp motors. The motors are equipped for automatic control. The air from the toilet rooms is removed by four motor-driven fans located on the roof. All of the foregoing motors are of Sprague make.

Automatic temperature regulation has been applied to all heating coils. The Powers system of thermostatic control is used and there are about 400 thermostats distributed throughout the building from which the supply valves and outlet dampers are controlled pneumatically. The system is operated with an air pressure of 15 lb. which is maintained by a compressor driven by a 1-hp Sprague motor.

Steam for heating is supplied by four 300-hp Heine boilers.

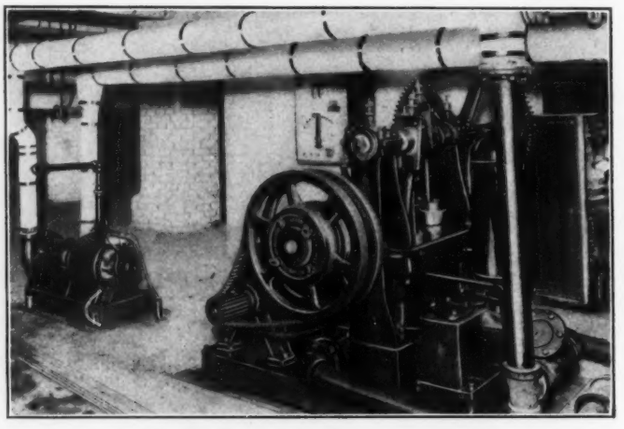


FIG. 14.—SPRAY PUMP AND RETURN CONDENSATION PUMP.

These are designed for 125-lb. pressure and will be used for a power plant, if it is found advisable to install one at any future time. An induced draft fan of Sturtevant make is installed, and this is driven through silent chain gear by a 40-hp Sprague motor.

There are 10 electric elevators in use of the Otis, magnet-control type; six of these are for passengers, two for passengers and freight and two for records.

The two house pumps for supplying fresh water throughout the building are driven by 3½-hp shunt-wound Westinghouse motors. They pump the water into a tank from which it is elevated by compressed air obtained from a 9½-hp Westinghouse traction brake compressor fitted for automatic control. A sump pump for ejecting tide water is driven direct by a 7½-hp Sprague motor and two compressors for ejecting sewage from the building are driven through raw-hide pinion gearing by two 7½-hp Crocker-Wheeler motors fitted for automatic control. All of the automatic controllers are of Cutler-Hammer manufacture excepting those used in the elevator equipment. The motors are practically noiseless in operation.

Mr. Burton Harrison was the engineer who laid out the electrical and mechanical equipment and Messrs. Peet and Powers,

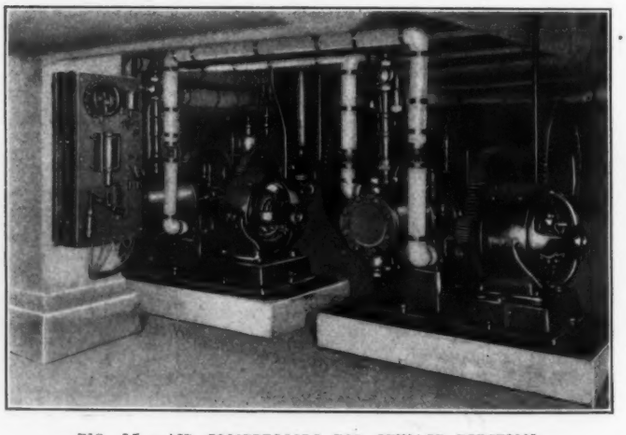


FIG. 15.—AIR COMPRESSORS FOR SEWAGE EJECTION.

of New York, were the electrical contractors. The ornamental lamp fixtures were supplied by the Mitchell Vance Company and the standard fixtures by the Cassidy & Son Manufacturing Company. Mr. Cass Gilbert, of New York, was the architect of the building.

Variable-Speed Commutating-Pole Motors.

BY A. G. ELLIS.

THE confidence with which it was generally proclaimed a few years ago that the employment of commutating poles removed all the disabilities to which continuous-current machines had been subject, has finally given place to a more guarded attitude in dealing with the design of such machines. Commutating poles are in certain legitimate fields and types the correct and most satisfactory solution to the commutation problem, but the very extensive application which accompanied their recent revival is not justified.

The impression that commutating pole designs permit of radical departures from standard lines of designs resulting in requiring less careful designing and in reduction of cost, is not borne out by a theoretical investigation of the subject nor by the results obtained.

Commutating poles are an unnecessary addition to machines which have good commutation qualities when designed on ordinary standard lines. It is better practice, wherever possible, to obtain good commutation by careful designing than by employing less careful designing and trusting to interpoles to take care of the commutation.

There are, however, certain classes of machinery where interpoles, or some similar commutating device, are a necessity in order to obtain good commutation. Such machines should, however, be designed carefully on standard lines with a view to obtaining as good commutation as practicable, and the interpoles should then be added to ensure satisfactory commutation.

Variable-speed motors constitute one class of machine to which interpoles are a useful adjunct on account of the commutation difficulties encountered at the higher portions of the speed range. Such machines, when the variation is effected by shunt field circuit control, must be proportioned for the heavy flux corresponding to the lowest speed.

At the lowest speed the iron parts of the magnetic circuit are saturated, but at the highest speed, where the field is very weak, the flux densities are very low and the iron sections are much larger than are required to carry the flux corresponding to the high speed.

Thus, for the case of the 40-kw, 200 to 1000 r. p. m. continuous-current motor outlined in Fig. 1, the flux per pole at 200 r. p. m. is 7.5 megalines, while at 1000 r. p. m. it is only 1.5 megalines. In order to carry this flux at the densities that correspond to 7.5 megalines, the magnetic circuit for the higher speed need only be one-fifth the cross-section at all parts. Thus, an armature of one-fifth the net core length and magnet cores of one-fifth the section would be sufficient. Such a machine is diagrammatically outlined in Fig. 2, which machine is of sufficient size for an output of 40 kilowatts. At 1000 r. p. m. a normal design for this rating and speed would, however, be proportioned more on the lines of the outline in Fig. 3.

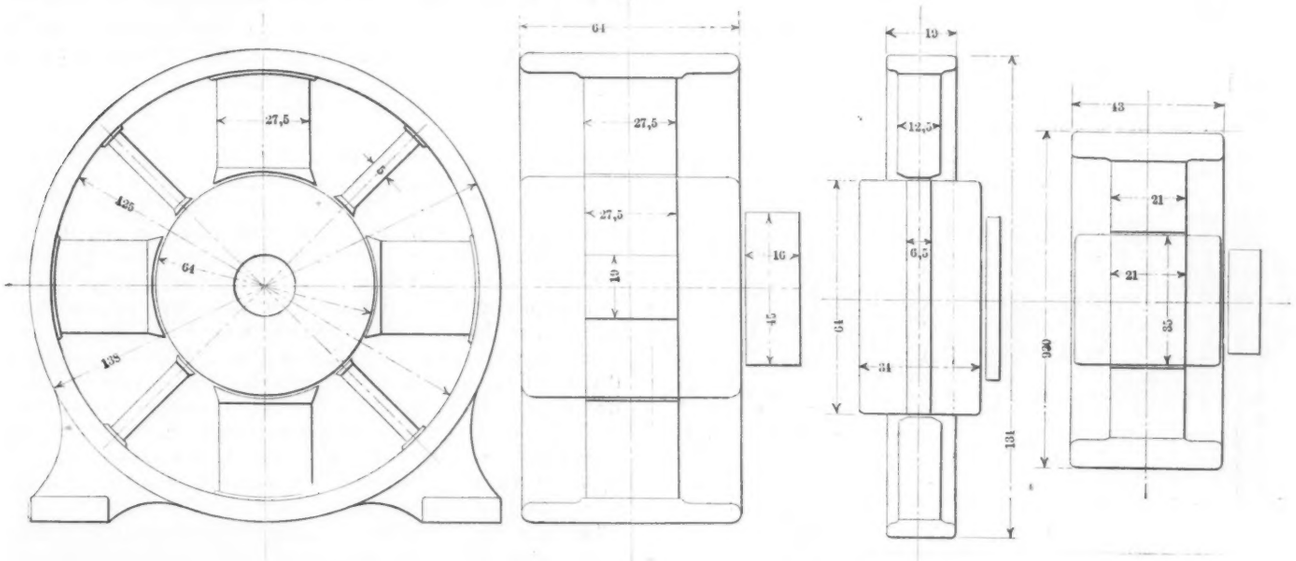
It is quite possible to obtain either of the designs in Figs. 2 and 3 without interpoles and with good commutation. When, however, the machine outlined in Fig. 1 is running at 1000 r. p. m. the commutation is poor at this high speed, owing to the reactance of the great lengths of conductor embedded in the armature core. When running at 200 r. p. m., the commutation is good, as the speed is so low, and the design is in all respects as regards commutation not an abnormal design for this speed.

The following tabulated statements of the reactance voltages permit of a good comparison of the commutating qualities in these various cases:

Design	a (Fig. 1)	b (Fig. 1)	c (Fig. 2)	d (Fig. 3)
R. P. M.	200	1000	1000	1000
Reactance voltage	1.66	8.3	2	1.5

While a reactance e. m. f. of 1.66 volts, as in design (a), is not sufficient to require interpoles, the reactance e. m. f. of 8.3 volts at 1000 r. p. m. is far too great for the machine to commutate satisfactorily without resort to interpoles or some equivalent means.

With motors for a smaller range of speed variation, the reactance voltage at the highest speed does not reach such a high value as in the present case, and, consequently, the commutation difficulties are not so great.



FIGS. 1, 1a, 2 AND 3.—OUTLINE DRAWING OF 40-KW DIRECT-CURRENT MOTORS.

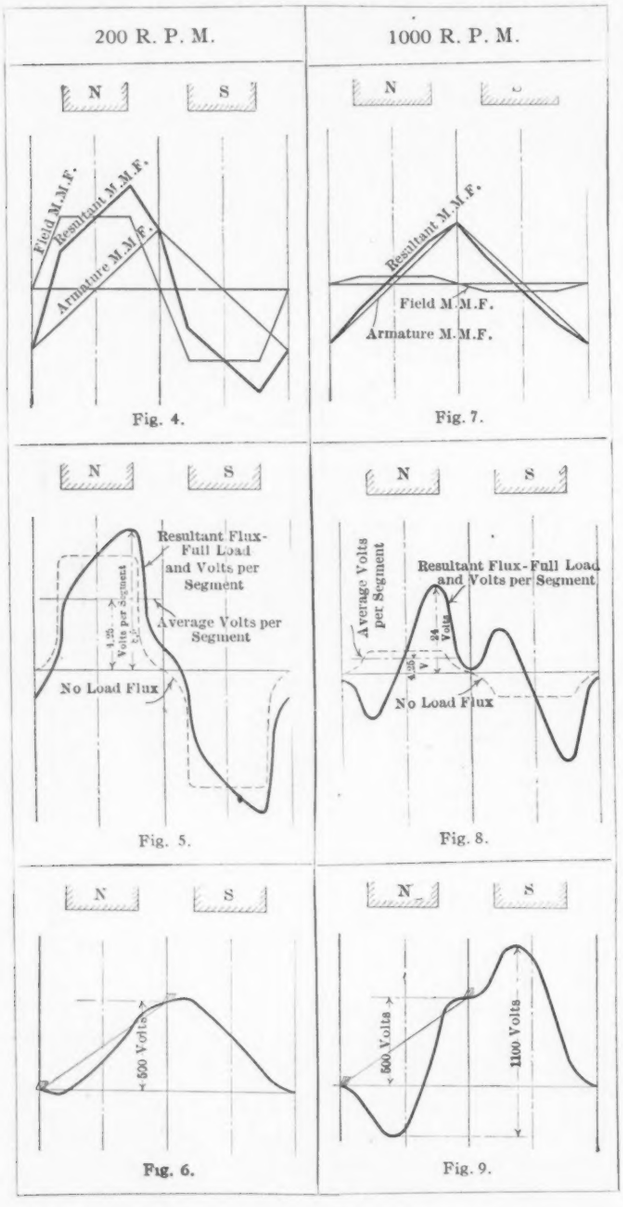
In designs where interpoles are required, there is a tendency to cheapen the design by employing even higher reactance voltages than are at all necessary. This is a consequence of employing comparatively few commutator segments, weak fields and many armature turns. In a design of this kind the whole dependence for commutation is placed on the interpoles. In machines designed on these lines a new difficulty is encountered. This relates to flashing over at the commutator, due to the distorting effects of the armature m. m. f. on the main field. This distortion is greater the weaker the field m. m. f., as compared with the armature m. m. f. Hence, when a variable-speed motor is running at its highest speed with the field weakest, the liability of flashing over is the greatest. A motor with a wide speed range may have at certain points of the commutator an e. m. f. per segment several times the average voltage per segment, and between certain points there may exist a voltage much greater than the actual terminal voltage.

These occurrences are illustrated in the curve of Figs. 4 to 9. The curves of Figs. 4, 5 and 6 relate to the lowest speed of 200 r. p. m., and the curves of Figs. 7, 8 and 9 relate to 1000

r. p. m., and apply specifically to the 40-kw motor. This motor, is designed with four poles and with 471 commutator segments. The machine being operated at 500 volts, the average e. m. f. per segment amounts to 4.25 volts.

This is a reasonably low value at the lowest speed; that is, at 200 r. p. m. The m. m. f. due to armature interference is then only able to slightly modify the m. m. f. emanating from the field spools, and the maximum voltage per segment is not greatly in excess of the average voltage; that is, it is not greatly in excess of 4.25 volts. From the curves in Fig. 5 it is seen to be approximately 8.5 volts.

While the armature m. m. f. is the unimportant component of the total m. m. f. at the lowest speed, namely, 200 r. p. m., it



FIGS. 4 TO 9.—FLUX DISTRIBUTION ALONG AIR GAP.

is the m. m. f. of the field spool, which is the unimportant component of the total m. m. f. at 1000 r. p. m., the highest speed so far as concerns the maximum gap density. This comes about as follows: The field spool m. m. f. at 200 r. p. m. is 5520 ampere-turns per spool, and the armature m. m. f. per pole, when supplied with energy at 500 volts and delivering 40 kilowatts, amounts to 4710 ampere-turns. Owing to the unfavorable position of the center of the armature polarity, that is, midway between the adjacent pole tips of neighboring poles of opposite polarity, the armature ampere-turns per pole are able to affect the resultant flux only to the extent indicated in Fig. 4. The curves in Fig. 4 represent graphically the m. m. f. due to the main pole field windings and the m. m. f. due to the armature ampere-turns. The combination of these two m. m. f.'s gives the curve marked "resultant m. m. f.," which produces the flux distribution in the gap shown by the black line curve in Fig. 5.

The dotted curve in Fig. 5 represents the flux distribution at no-load, which corresponds to the *field m. m. f.* curve in Fig. 4. At no-load the field m. m. f. is, of course, the only m. m. f. present, the armature ampere-turns being zero. The black line curve in Fig. 5 represents the flux distribution at full-load, which corresponds to the curve of *resultant m. m. f.* in Fig. 4. The ordinates of this curve are also proportional to the volts per segment. If the flux from each pole were uniformly distributed over the whole of the polar pitch area, the volts per segment would be uniform around the commutator, as indicated by the straight line curve in Fig. 5. As will be seen from Fig. 5 the e. m. f. per segment reaches at no-load a value of 7 volts, or 1.65 times the average, and at full-load a maximum value of 8.5 volts, or twice the average of 4.25 volts.

By integrating the volts-per-segment curve of Fig. 5 there is obtained a curve of commutator voltage distribution, as shown in Fig. 6. This curve shows that the maximum voltage which occurs at certain points is slightly in excess of the terminal e. m. f. of 500 volts.

At the highest speed of 1000 r. p. m., the conditions are as shown in the curves of Figs. 7, 8 and 9. Firstly, the field m. m. f. is reduced to a value sufficient to produce a flux of one-fifth that in Fig. 4. Although the flux is reduced to one-fifth, the m. m. f. necessary to produce this flux is reduced to an amount considerably less than one-fifth on account of the decrease in the reluctance of the iron parts of the magnetic circuit (principally the teeth) on account of the decreased flux densities. The armature m. m. f. is, however, the same as in Fig. 4, and is now very great in comparison with the field m. m. f. Consequently, the armature has a predominating influence on the curve of resultant m. m. f., as shown in Fig. 7. In Fig. 8 there is derived the resultant flux curve similar to that in Fig. 5. It will be observed that the flux curve is much more distorted at 1000 r. p. m. than at 200 r. p. m., and the ratio of its maximum to its average value is much greater than in the former case. Thus, the maximum e. m. f. per segment reaches in this case a value of 5.7 times the average e. m. f. per segment, or $4.25 \times 5.7 = 24$ volts. This value is exceedingly high.

In Fig. 9 there is derived the commutator voltage distribution curve from which, on comparison with the curve for 200 r. p. m. in Fig. 6, it will be seen that the maximum e. m. f. which occurs is considerably greater, reaching, in fact, about 1100 volts. This is due, as was noted, to the great distorting effect of the armature m. m. f. consequent upon its predominating influence. Such phenomena are most marked when dealing with so wide a speed range as 5:1, as the field in such cases is very weak at the highest point of the speed range. With smaller speed ranges, such as 4:1 or 3:1, the difficulties are not so great, since at the highest speed the armature m. m. f. does not predominate to so great an extent.

The field distortion may be decreased by employing a higher ratio of field m. m. f. to armature m. m. f.; that is, a relatively greater field m. m. f.

For the design considered above, the extent to which the field strength influences the commutator voltage distribution has been investigated, the commutator voltage curves have been derived, using a field m. m. f. twice as great as that employed in the normal design for this motor. The comparison of the two cases is shown by the curves in Figs, 10 and 11, where the curves marked *A* in Figs. 10 and 11 are reproduced from Figs. 8 and 9, respectively. It will be seen that in case *B*, the maximum value of the volts per segment is decreased from 24 to 18, or from 5.7 to 4.3 times the average. Also the maximum commutator voltage is decreased from 1000 to 750. This is

still 1.5 times the terminal voltage, and is not a great improvement considering that it has required doubling the field excitation, with a corresponding increase in the amount of field circuit copper and field copper losses.

Attention has already been called to the tendency, when interpoles are employed, to design with weak fields and few segments, with the idea of effecting economy in the construction. From the above conditions, the deleterious effects of such procedure should be obvious.

If in the 40-kw design there had been employed half the number of commutator segments, the average e. m. f. per segment would have been 8.5 volts and the maximum value occurring at 1000 r. p. m., 48 volts, which would certainly lead

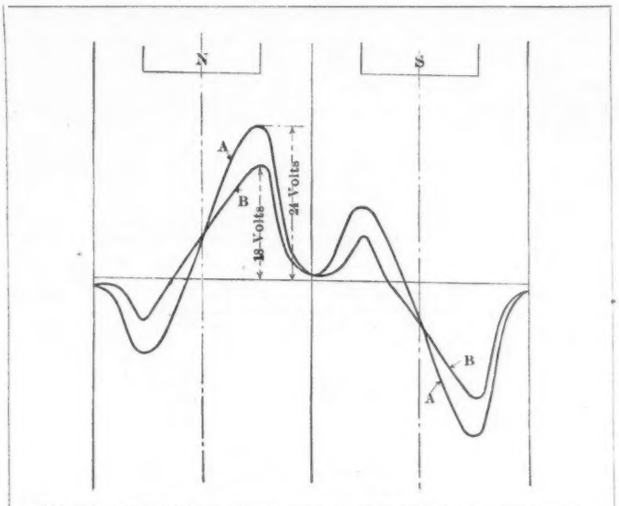
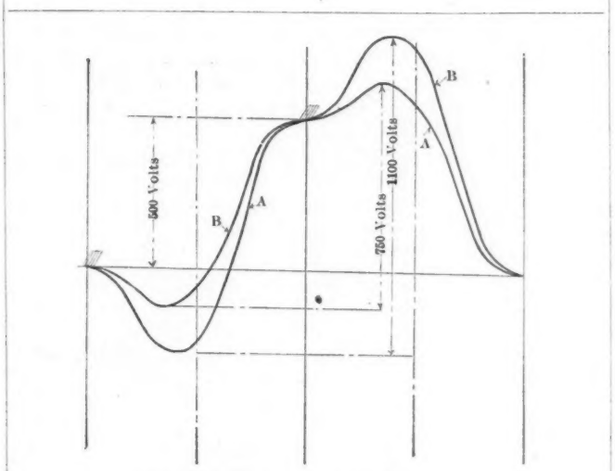


FIG. 10.—RESULTANT FLUX CURVES AND VOLTS PER SEGMENT.



A—Field strength, same as in Fig. 4.
B—Field strength, double that in Fig. 4.

FIG. 11.—COMMUTATOR VOLTAGE DISTRIBUTION.

to flashing over at the commutator. It behooves designing engineers to limit the maximum value liable to be obtained by the volts per segment, under any conditions of operation, to a low figure. This leads to many commutator segments and confirms the view put forward repeatedly by the more conservative designers, that the use of interpoles affords insufficient reason for abandoning those lines of design which have been demonstrated as sound, but that interpoles should be pressed into service only in those ranges of work where good commutation cannot be obtained by the ordinary type of design, and that when interpoles are employed they should be used in conjunction with good features in other respects. It is useless to evade the fact that this leads to expensive machines. Interpoles are invaluable in many cases, but their use does not lead to cheapness, but rather, when rightly proportioned, to superior quality.

Breslauer has stated that good results with interpoles require a wide neutral zone; that is, a small ratio of pole-arc to pole-pitch. It has already been pointed out that the pole shoe of the interpoles should span several slots, and that an interpole machine should have many slots to work well. Every one of these features leads to a design of generous dimensions, but it does not lead to cheapness. It is thus to be hoped that the precipitancy of manufacturers who have committed themselves to interpoles for all their machines, and who, having developed the designs, cannot now draw back, will produce at least the good result of having paved the way for correctly designed interpole machines with plenty of segments, liberal neutral zones, generous pole-arcs for the interpoles and liberal numbers of slots. These machines will not be cheap machines, but they will, when intelligently proportioned, be high-class machines and there may thus be set up a standard of excellence which, in spite of the higher cost entailed, will come to be regarded as normal.

In conclusion, it may be said that for certain ratings and ranges of speed variation, motors should be built with interpoles, as should also quite a wide range of high-speed continuous-current generators. For less extreme ratings, interpoles may also be used, and with suitable proportions, their use ensures extra high-class results. These proportions, however, entail considerably higher cost, and the claim that for ordinary moderate-speed and low-speed ratings the use of interpoles ensures a high-grade result at low cost, is not borne out by results.

Measurement of the Coefficient of Self-Induction of a Circuit Under Normal Load.

By C. C. CHAPIN.

The determination of the inductance of a circuit under an actual load presents the special difficulty that the effect of the inductance is quite largely obscured by that of resistance. Thus in a circuit in which the value of the reactance is 10 per cent of the value of the resistance, the excess of the impedance over the resistance is only ½ per cent; and if one would calculate the value of the coefficient of self induction from the formula $I = \frac{E}{\sqrt{R^2 + (2\pi f L)^2}}$ with any considerable degree of accuracy, the measurements of E and I must be made with an accuracy much greater than can be obtained with alternating-current instruments now available. It is to eliminate the difficulty connected with the use of the impedance equation, and yet to allow the circuit to be under full load

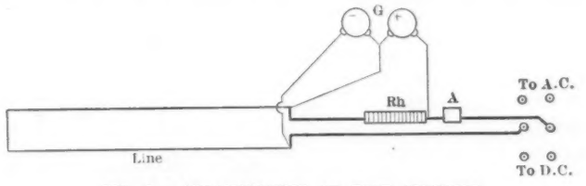


FIG. 1.—ARRANGEMENT OF TEST CIRCUITS.

during test, that the method outlined below has been devised.

The plan consists essentially of separating the counter e. m. f. of inductance from that of resistance, and measuring it alone. This is accomplished by the use of a differential galvanometer in which the counter e. m. f. of resistance of the test circuit is neutralized by that of another equal resistance placed in series. The scheme is shown in Fig. 1. The counter e. m. f. of resistance of the line under test is balanced by that of an accurately equal non-inductive resistance, R_A, placed in series with it, the connections to the galvanometer being such that the directions of the currents in the two coils are opposite. That this balance could be obtained may be readily seen by observing that the two portions of the circuit (the line and the rheostat) are in series, and that hence the currents in them

must be in the same phase, and have the same instantaneous values, and give the same counter e. m. f. of resistance at all times. By impressing these two equal and synchronous potentials, due to resistance effects, on the two coils of the galvanometer in opposite directions, so that their magnetic fields oppose and neutralize, the resultant value of the counter e. m. f. of resistance acting upon the galvanometer needle will be zero, leaving the counter e. m. f. of inductance for measurement by itself.

This may be illustrated graphically in Fig. 2. When the counter e. m. f. developed in the main circuit is resolved into its component parts, and these are opposed as in the galvanometer, they have the relations indicated. Since the resistance of the two coils of the galvanometer are equal, the currents in the two will be in the same ratio as the potentials acting upon them; and since the counter e. m. f.'s of resistance impressed on the two coils are continuously equal, it is evident that the resulting galvanometer currents, due to resistance effects in the main circuit, will be continuously equal and opposite, and that their magnetic effects in the galvanometer will neutralize. In this way the counter e. m. f. of resistance of the circuit under test is eliminated, and the counter e. m. f. of inductance is left for separate measurement.

The value of the counter e. m. f. of inductance is $2\pi fLI$, and if its value E be known, then L can be determined, for $L = E \div 2\pi fI$. Here, any error which may occur in the measurement of I or E is not magnified when appearing in the value of L, as in the method involving the impedance formula.

The galvanometer used in the following test is one designed by Dr. Bergen Davis, of Columbia University, and modified by the writer for use as a differential instrument. The needle consists of a bundle of fine iron wires suspended by a quartz fibre between the two halves of the galvanometer coil, and is set in a horizontal plane with its axis at an angle of 45 deg. to that of the coil, one component of the field of the coil magnetizing it, and the other producing the deflecting torque. The whole instrument is heavily shielded from external magnetic fields by means of soft iron cylinders. For the purpose of the experiment the coil of the instrument was replaced by one consisting of two parallel circuits, permitting a differential action. The resistance of each of these coils is 56 ohms, and the sensitiveness of the galvanometer is such that 0.01 volt alternating e. m. f. placed across the two coils in series, so connected as to add their magnetic effects, gives a scale deflection of about 33 mm. Special tests have shown that its action is entirely independent of the frequency, at least within the commercial limits of frequencies.

In an instrument of this class, in which the deflection varies as the square of the impressed e. m. f., the accuracy is much better at large deflections than at small. Hence it is advisable to keep the needle at some standard deflection well out on the scale, and obtain measurements by observing the resistance which it is necessary to place in series with the galvanometer to produce this standard deflection. When applied to a differential galvanometer this method becomes somewhat complicated, but with the arrangement shown in Fig. 3, the measurements may be made quite easily. Assume a conductor in which there is a current, and let there be potentials developed along it having the successive values P_1, P_0 and P_2, as indicated. Currents will flow in the three branches of the galvanometer circuit, depending upon the resistances R_1, X and R_2. The values may be found as follows:

I	X	R_1	K	L Millihenrys: for circuit	L Millihenrys: per mile	Variation from computations for similar copper circuit	REMARKS
3.34	30	156	.000941	.0806	1.86	+ 4 %	Copper wire, No. 9, spaced 12 inches.
3.48	34	156	.000941	.0804	1.85	+ 3 %	Length of each side of circuit, 114 feet 6 inches.
7.65	169	156	.000941	.0807	1.86	+ 4 %	L. per mile (computed for similar copper circuit) = 1.79
8.52	197	156	.000941	.0807	1.86	+ 4 %	
3.16	33	156	.000941	.0877	2.03	+ 0.5%	Copper wire, No. 9, spaced 24 inches .
3.28	36	156	.000941	.0867	2.01	− 0.5%	Length of each side of circuit, 114 feet
8.10	216	156	.000941	.0907	2.10	+ 4 %	L. per mile (computed for similar copper circuit) = 2.02
8.02	214	156	.000941	.0908	2.10	+ 4 %	
4.10	64	256	.000936	.116	2.66	+ 49 %	Monnot duplex wire, No. 9, spaced 12 inches
6.41	220	256	.000936	.135	3.10	+ 73 %	Length of each side of circuit, 115 feet
8.56	10	1056	.000936	.156	3.58	+100 %	
8.52	410	256	.000936	.157	3.60	+100 %	
2.92	17	256	.000936	.123	2.83	+ 40 %	Monnot duplex wire, No. 9, spaced 24 inches
4.20	85	256	.000936	.132	3.03	+ 50 %	Length of each side of circuit, 115 feet
6.29	244	256	.000936	.147	3.38	+ 67 %	
9.77	560	256	.000936	.175	4.02	+ 99 %	

The equations of potential for the two galvanometer circuits are:

$$P_1 - P_0 - R_1 I_1 + X I_3 = 0$$
$$P_0 - P_2 - R_2 I_2 - X I_3 = 0$$

also $I_2 - I_1 = I_3$.

Placing $R_1 = R_2$ (which condition is also imposed on the galvanometer circuits) and solving,

$$I_3 = (2P_0 - P_1 - P_2) \div (R_1 + 2X)$$

Now $(2P_0 - P_1 - P_2)$ is the difference between the potentials developed in the two parts of the main circuit, thus:

$$(P_0 - P_2) - (P_1 - P_0) = 2P_0 - P_1 - P_2$$

Or, calling this difference E,

$$I_3 = E \div (R_1 + 2X)$$

By adjusting the resistance X so as to keep the galvanometer needle at some standard deflection, the current I_3 is kept constant.

$$\text{Then } K' = \frac{E}{R_1 + 2X}, \text{ or } E = K\left(\frac{R_1}{2} + X\right)$$

As mentioned previously, $E = 2\pi fLI$; hence

$$2\pi fLI = K\left(\frac{R_1}{2} + X\right)$$

and

$$L = K\left(\frac{R_1}{2} + X\right) \div (2\pi fI)$$

The value of the constant K is determined by calibrating the instrument with each of its coils connected across one of two non-inductive carbon plate rheostats in series, in which there is an alternating current. The resistance of each rheostat is measured with a bridge, and the current noted, whence the e. m. f. impressed on the two coils is readily calculated.

For the purpose of adjusting the resistance of the carbon rheostat to exact equality with that of the line, a double-throw

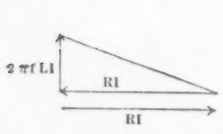


FIG. 2.—VECTOR DIAGRAM OF IMPEDANCE.

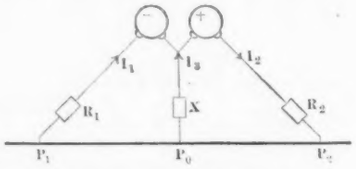


FIG. 3.—SIMPLIFIED DIAGRAM OF TEST CIRCUITS.

switch is inserted in the generator leads, as shown in Fig. 1, by means of which direct current may be used on the line. By adjusting the rheostat with direct current in the circuit until no deflection of the galvanometer is obtained, the resistance of the rheostat is made just equal to that of the line.

Several representative tests are recorded on the preceding page, each made at 60 cycles per second.

In the results given it is to be noted that the values of L found for the copper circuits are fairly constant for a given spacing, and that their variation from the computed values is smaller than that which may occur in actual practice due to distortion of the wave form. Thus D. C. Jackson in his work on alternating currents quotes Emmet to the effect that "in practice the current is usually not sinusoidal, and the actual reactance is therefore likely to be increased from 5 per cent to 25 per cent, depending on the elements of the circuit and the distortions of the current curve." The tests above on the copper circuit may, therefore,, be taken as a fair confirmation of the method within the desired commercial limits of accuracy.

The tests on the Monnot duplex wire are instructive in showing the effect of the presence of iron in the magnetic field of the circuit, the inductance increasing very decidedly with increase of current. In this wire the iron of the core is centrally located with respect to the copper, and the magnetic field acting upon it is very weak, corresponding to the very low values of magnetic stress on the permeability curve. Hence it will be seen that the inductance of such a circuit follows the permeability curve of the iron (in which the permeability begins at unity and increases with

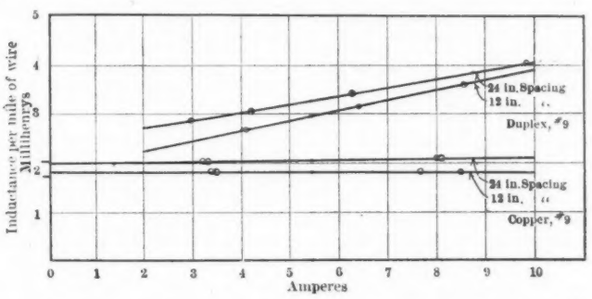


FIG. 4.—CURVES SHOWING VARIATION OF INDUCTANCE WITH THE CURRENT IN MAGNETIC WIRE.

strength of field, for low values of magnetic stress); and that the inductance is equal to that of a similar copper circuit, plus an added amount dependent upon the permeability of the iron and the magnitude of the current. This is more clearly shown by the curves of Fig. 4, where it will be noted that as the current approaches zero the inductance of the duplex wire approaches that of a copper, or non-magnetic, circuit. It is interesting to note that while the inductance of a circuit of this wire is somewhat greater than that of a similar copper circuit, the ratio of inductance to resistance is less than for copper, at least within the range of the current values used.

It is evident, then, that in a conductor in which iron forms an important part the inductance will increase with the current, at least up to a comparatively high limit. And in a circuit consisting entirely of iron it would seem that the inductance might change very greatly with the current, depending upon the permeability curve of the iron and the magnetic stress upon it; and that determinations made with other than the normal load on the circuit might be far from correct.

It is believed that this method furnishes a practical means for determining the inductance of a circuit under its normal load, and with an accuracy well within the variations caused by distortions of the current curve in actual practice. It may be noted that the method is also applicable to the determination of capacity, and of skin effect.

The writer desires, in conclusion, to thank Professor George F. Sever, of Columbia University, for the excellent engineering equipment placed at his disposal for making the above tests.

Proposed Consolidation of London Electric Supply Systems.

Following the various proposals for concentrating the production of electricity in London which have been unsuccessfully submitted to Parliament during the past three or four years, three new schemes are about to be brought forward. It will be remembered by readers of the ELECTRICAL WORLD that an important scheme was put forward in 1905, with a strong financial backing, for the purpose of establishing two very large power houses in the east end of London, from which it was proposed to sell electricity for power purposes only to the numerous railway companies and manufacturers in the industrial parts of London. During the exhaustive hearing which that scheme had before committees of both houses of Parliament, by whom it was passed, a number of very remarkable facts concerning the present state of electrical supply in London and surrounding districts were made public. Particulars of these were furnished in these columns at the time and need not be recapitulated at any great length. It may be said, however, that the condition of affairs then discussed is practically no better to-day.

The supply of electricity in the London district is now in the hands of about 73 separate authorities, some of which are private companies, while in other cases the supply is given by the local town council. In many cases, and especially in the central and most profitable areas, companies are in competition with each other; but in practically every case where the supply is in municipal hands a monopoly has been granted and the right to compete always refused.

The supply is given from between 60 to 70 independent generating stations, many of which are of small size and antiquated design, containing in some cases units below 100 kilowatts in size. The average capital expenditure upon these stations has been over $250 per kilowatt of plant installed, and although the more recent stations have been erected somewhat more economically, the extensions which are now being carried out in the larger of them are costing in most cases $150 per kilowatt. Electrical energy is generated on nearly 20 different systems of frequency and voltage, and there is a corresponding variety of tariffs, the price for electricity varying from 1½ cents to 16 cents per unit, while in some cases as much as 20 cents per unit is authorized as a maximum. The average size of the plant installed is under 400 kilowatts, the average size of the generating stations being under 3000 kilowatts, and altogether over 500 separate generators are used for supplying, exclusive of exciters.

The wastefulness of this method of supply and the great economies which might be effected by concentration have long been realized. In fact, so far back as 1889, Ferranti, having acquired the rights of supply over a large area, including nine different parishes, made his historic attempt to concentrate and enlarge the scale of production at the Deptford generating station, the first place in England to use 10,000 volts and paper cables. This attempt was, however, unsuccessful, not because it was in any way wrong in principle, but mainly because the manufacturer of electrical apparatus was not at that time in a position to supply the engineer's requirements as regards size of units and electrical pressure. In short, it was before its time. Nevertheless, this important undertaking was the pioneer attempt at concentration and to its example is owing the subsequent attempts which have been made in the same direction.

After the failure of the Deptford experiment, nothing drastic was done for some years. Some of the larger companies, however, notably the Metropolitan Electric Supply Company, carried out a gradual policy of removing or abolishing their smaller and more antiquated power houses, and this company has concentrated its supply at a large power house erected on the northwestern outskirts of London, at Willesden. Another corporation, the Charing Cross & Strand Company, erected a large station at Bow, on the eastern outskirts of London; while two more, the St. James' and Westminster Companies, combined to put down a new station in the neighborhood of Re-

gent's Park for the purpose of producing electricity more cheaply than could be done from their own power houses, situated in the heart of the West End: In none of these cases, however, was any attempt made to extend the area in which the supply was authorized to be given, neither was there any amalgamation of conflicting interests. The latter was, in fact, not possible, for the board of trade, with the object of perpetuating competition in the interests of the consumer, had from the very outset inserted clauses in the charters of the various companies making "association" illegal. Even had it been legal, it is doubtful whether the conflicting financial interests which control the various companies could have drawn together; and even if they had, complete combination was out of the question owing to the large number and varying constitutions of the municipal bodies, who also possessed rights of supplying electricity.

In 1904, however, the new company, above referred to, known as the Administrative Company, was incorporated for the purpose, not of directly consolidating the existing interests, but for putting down a very large system with power houses of greater size and on more economical sites than those in existence, with the object of supplying electricity in bulk to the existing authorities and to the individual power users. The right of supply to the ordinary lighting user, who at that time formed nearly 90 per cent of the total demand, was not sought. The hearing of that proposal was so protracted that, although it passed committees of both houses of Parliament, it just failed to become law before the close of the session of 1905. It was vigorously opposed by the existing interests, both private and municipal, which had brought forward alternative proposals of their own. In 1906 the London County Council also brought forward a proposal for establishing a great municipal system, which, however, was rejected by Parliament, only to be reintroduced in a still more ambitious form in 1907, when it again failed. Up to the present, therefore, the position of affairs in London is very much the same as it was five years ago.

In the new session of Parliament, just beginning, three schemes will be brought forward, as already mentioned. The first, known as the London Electric Supply Bill, is a proposal promoted by eight of the largest London companies. These between them have sunk 80 per cent of the capital expended by companies in electric light in London, and probably have an output exceeding all the other companies and municipal undertakings put together. In the present bill they do not propose to establish any new generating station; their main object is to secure the repeal of the present restrictions against "association" and amalgamation. They ask Parliament to give them the right of selling electricity to each other and to any other authorities in London in bulk, and they delineate a very large area in and around London in which they seek to exercise these powers of selling in bulk. They do not, however, seek any additional powers of supplying individuals, possessing as they do full powers of supply within their own areas, while in the new areas sought they are content to leave the retail distribution in the hands of the existing supply authorities, allowing the latter to purchase their supplies in bulk. The method proposed is the establishment of a joint committee of all these undertakings with power to raise capital and to do other things necessary for this purpose. As usual in these cases, their bill includes power to the municipal authorities to purchase the undertakings, in 1932 or 1952. In the former case the terms of purchase are, of course, somewhat more remunerative than in the latter case, when the capital expenditure alone is to be made good. The prices fixed by the bill at which the joint committee will be bound to supply electricity in bulk to any authorized distributor must not exceed $25 per annum per kilowatt of maximum demand and 0.7 cent per unit.

Company.	System of generation.	Kilowatts of plant installed.	Units sold.
Brompton & Kensington Company	Single-phase.	2,575	2,779,337
Charing Cross Company, Ltd.	Direct.	20,400	16,665,001
The Chelsea Company, Ltd..	Direct.	3,500	3,307,714
City of London Company, Ltd.	Direct and single-phase.	24,000	21,664,103
County of London Company, Ltd.	Direct, single and two-phase.	11,000	10,755,424
The London Electric Supply Corporation	Direct, single and three-phase.	12,800	10,544,484
Metropolitan Electric Supply Company, Ltd.	Direct, single and two-phase.	18,500	10,515,836
South Metropolitan Electric Light Company	Two-phase.	3,095	2,381,788

The following table gives a list of the companies joining together for this purpose, together with particulars of their output and systems for the last year for which complete records are available.

The above joint scheme did not commend itself to all the companies, and some of the smaller ones operating in the West End are promoting an independent scheme, which does not necessarily run counter to the one already described. In this bill, entitled the London (Westminster & Kensington) Electric Supply Companies, the powers sought are very much less than in the larger measure. No new area of supply is asked for, the rights sought being practically for granting the companies permission to interchange energy in bulk; they do not affect the consumer in any way, and in neither of these new bills is there any new generating station proposed.

The final scheme to be considered, entitled the London & District Electricity Supply Bill, is being promoted by an independent company and follows very largely the lines of the great scheme promoted in 1905 and 1906 by the Administrative County of London & District Electric Power Bill. The new company also seeks powers over a very extended area in and around London, covering in all some 400 sq. miles. It proposes throughout this area to give supplies in bulk to the existing companies, whether company or municipal, which they may retail as at present, and they undertake to give this supply, whether to authorized distributors or railway companies, etc., at the following prices:

(a) For a supply of alternating current, untransformed, at the rate of a fixed sum of $15 per annum per kilowatt of maximum power required to be supplied, and in addition a sum of 0.5 cent per unit for all units supplied to such consumer.

(b) For a supply of transformed alternating current at the rate of a fixed sum of $17.50 per annum per kilowatt of maximum power required to be supplied, and in addition a sum of 0.6 cent per unit for all units supplied to such consumer.

(c) For a supply of direct current at the rate of a fixed sum of $22.50 per annum per kilowatt of maximum power required to be supplied, and in addition a sum of 0.66 cent per unit for all units supplied to such consumer.

These are prices for bulk supply, but the new company also seeks powers to compete with the existing companies and municipal undertakings for power supply to individuals however small their demands. These powers are as follows: In brief, in cases where the maximum demand exceeds 250 kilowatts, they are classed as bulk consumers, and the company seeks to supply without any restriction as regards competition, subject always to the above prices. For consumers below 250 kilowatts, the new company must be prepared, if it wishes to supply them with power, to quote a price below that at which it is prepared to supply the existing companies in bulk by at least 1 per cent in respect of each 10 kilowatts by which the consumer's maximum demand is below 250 kilowatts. In other words, it is proposed that the existing companies and municipalities should, if they prefer, purchase in bulk and retail current to the power consumer as they are in any case entitled to do to the lighting consumer. They are obliged, however, unless they wish the power consumer to be supplied direct by the new company, to supply the power consumer themselves at a price which does not exceed the price they pay the new company for their bulk supply by more than the percentage fixed above. For example, if they purchase current at 2 cents per unit in bulk, they must be prepared to retail that current to the consumer whose maximum demand does not exceed 10 kilowatts at a price not exceeding 1.25d., and if they do not choose to do this, then the consumer is to have the right to obtain a supply direct from the new power company. The reason for the insertion of this clause is to compel the existing companies to

purchase their supplies in bulk from the new company, or, if they refuse, to still enable the consumer to get cheap power.

A new generating station is proposed about 10 miles out of London, at Barking, practically on the same site as that proposed by the Administrative Company, and from here energy will be probably transmitted at 20,000 volts up to London and distributed from various sub-stations.

As the London County Council is not promoting a bill this year, the issue to be fought out is somewhat simplified and will rest between the existing companies and the new company almost entirely. It will probably be contended on behalf of the new company that for reasons of economy a new station on a large scale and with a cheap site outside London altogether, is necessary in order that electricity can be produced at very low cost, and that London may benefit from an increase in its scale of production. On behalf of the existing companies, it will probably be contended that in view of the capital which they have already expended it will be more economical to develop the existing station than build an entirely new one, and that in any case as the pioneers who have obtained experience in supplying electricity in London, they should be entrusted with the right to make the modifications now required.

The Public's Debt to the Public Service Corporation.

At the Northwestern Electrical Association convention at Milwaukee, Jan. 15, Mr. W. R. Putnam, manager of the Red Wing Gas Light and Power Company, of Red Wing, Minn., presented a brief paper on the above subject. He said that our business has grown so rapidly that the men actually engaged in its management have with difficulty followed its growth, and much less have our legislative bodies been able to devise proper means for the control of the large and small corporations which have been the outgrowth of the new conditions. Various legislative bodies have attacked this problem with a determination to solve it. Unfortunately for the investor, and for the general business world as well, their aim has been to secure "action" and to pass legislation after only a few weeks' or months' consideration to regulate systems of transacting business which have taken years to develop.

The American people are an enthusiastic body and when they set out to accomplish a purpose they are incessant in their demands. When their enthusiasm is quieted down and they give due consideration to all phases of the question, they are preëminently a fair people. For the most part, franchises, when first given, were so granted because the people were as eager to have the service as capital was willing to supply it. Such being the case, franchises did not contain provisions which properly safeguarded the rights of either party interested, with the result that there has been almost constant wrangling between both parties involved on some or all of the questions of service, rates, taxes and various rights covered by the franchise. Meanwhile the communities supplied have been rapidly growing in population and area and the people's desire for all of these conveniences and necessities have grown even more rapidly. The franchise owner has kept pace with this growth by the investment of immense sums of money, both in the manufacturing and distributing department of his plant. At the same time, he has been obliged to keep up with the rapid improvement of appliances by replacement again and again of obsolete machinery. This has been done, it is true, with the purpose of enhancing the value of the property and of securing a fair return on the investment. At the same time it has been also in response to the people's demand.

Because of the apparent ease with which the funds have been secured for the immense development of electrical plants, the public has become firmly convinced that of necessity there must be immense profits in the business. They have not studied the question thoroughly or they would have soon learned that for every dollar received in gross earnings each year, there are from $3 to $10 invested in the business; in other words, from 20 to 60 per cent of the total receipts must be used to pay interest on the investment. The United States census returns show that the net earnings of all gas and electric concerns in this country before providing the depreciation funds and before paying interest charges, are only 8 per cent on the capital stock. The public has taken it for granted that it has been unfairly and in some cases dishonestly dealt with by the owners of franchises, and now not only insist on regulation, but on penalizing the franchise owner for his unfair and dishonest acts of the past. Whenever this unfairness has existed, has not the public been as much to blame as the franchise owner in electing men to office who have been the means of this unfairness and dishonesty?

The public service manager is human, and if he ascertained that the only way he could secure legislation or even a permit necessary for the carrying on of his business was by dealing dishonestly with a dishonest representative of the people, he followed too often in the past the line of least resistance. Should not the people's fairness accede to eliminating entirely from the subject of regulation the question of penalty?

The two largest associations of public utility corporations in this country have both gone on record as strongly in favor of reasonable regulation by the people. If the people will come to a realization of the immense good they derive from electric service; will give credit for new attempts to conduct the business honestly; will drop all ideas of penalty; will concede that efforts to develop business are entitled to a fair return; will drop the tendency to regulate rates by competition, and will approach the subject in a fair, conservative way—then, and only then, will regulation be secured which will establish, with the investor, the feeling of security necessary for the further enlargement of our business.

Mr. I. P. Lord, in discussing the paper by Mr. Putnam, said that it was based upon sound truth, but just how we are going to remedy this misunderstanding or misapprehension of the public is what all would like to know. Two wrongs do not make one right. The fact that there are dishonest men in the common councils does not excuse a corporation manager or promotor for being dishonest himself. The fair, outspoken action of any man will win in the end. Secrecy is not the direct road to success in public utility matters. Do not let the public get the impression that your business is a very mysterious one.

Do not try to carry the idea to them that it is a good, nice, well-paying business, for it is not. If they ask some questions that are perhaps a little bit personal about your business, enlighten them. The trouble is that the public has looked upon an electric lighting company as a mysterious, money-making, grasping corporation which is trying to get all the money it can out of the consumer by selling something for a dollar which costs a very small portion of a dollar. Heretofore, the common councils of different cities have taken it in their own hands to regulate the corporation. That is where the trouble has been. It is well the day has come that Wisconsin has a public service commission. We are out of the hands of the people who do not understand us. Our business will now be regulated by a body of fair, honorable men who will have no personal grievances at issue. They will inform themselves as to our business, and doubtless the time is rapidly approaching when public service corporations in the State of Wisconsin will be well taken care of. They will not be bankrupted and they will not have temptations thrown in their way to become bribe givers. It will work out not only to the good of the lighting companies in the State, but to the good of the public as well.

Mr. Utley, of Watertown, agreed with Mr. Lord that the State commission was a good thing and that companies ought to co-operate with the commission and get the basis of charges and rates where they ought to be. He thought it would only be a question of a few years when investors would be pleased with this kind of investigation. Mr. Parker, of Green Bay, also talked along the same line, agreeing with the previous speakers.

Education of Customers.

At the Northwestern Electrical Association convention, at Milwaukee, Jan. 15 and 16, some little discussion was given to the matter of educating customers to understand reading the meters and other matters pertaining to their use of electric current.

Mr. John Wright, of Antigo, Wis., thought that in talking to customers it is well to give them a little education as to the meaning of kilowatts, volts and amperes, because the more they get educated, the better they will understand the company and its business will not seem so mysterious to them. He thought it a good plan to give fuse plugs to customers and show them how to put in their own fuses. He would not attempt education to the extent of boring the customers, but to educate them as far as possible in the ordinary terms, because these terms are marked on their bills anyway and it is well to give them all the information possible. He thought it would be a good plan to have small pamphlets printed and enclosed with the bills from time to time. He often thought he would do that and expected to do so very soon if he could get suitable information made out and printed on small slips.

Mr. O. M. Rau, of the Milwaukee Electric Railway & Light Company, said that his company had published a small pamphlet of the kind suggested which would no doubt be a good starter for anyone wishing to issue such a pamphlet. This pamphlet tries to explain some of the terms and the methods of conducting electric light business. When a customer makes inquiry they hand him one of these pamphlets, and they find the next time he comes around he knows much more than he did before. Some of these pamphlets were later distributed at the convention. They are chiefly devoted to information pertaining to the reading of meters which the company has on its lines, but explain other things in connection with the service, including how to apply for electric service, lighting rates, power rates, lamp renewals and some other matters. The pamphlet consists of 20 pages, a page being 3¼ ins. x 6 ins., of a size to go in a common envelope. Mr. Strong, of Chaska, Minn., said that his experience was that when people know how to read their own meters kicks disappear. He showed his customers how to keep tab on their meters by leaving with the complaining customer a meter book-leaf with the dials printed on it, marking the position of the pointers so that each month he can check his own meter and see that there is nothing tricky in the readings.

Recent Development in Single-Phase Variable Speed Motors.

Mr. F. L. Kaufman, of Beloit, Wis., read a paper on the foregoing subject before the Northwestern Electrical Association, at Milwaukee, Jan. 16. The advocate of direct-current has for many years claimed as one of its distinctive advantages the possibility of providing and maintaining satisfactory variable-speed, direct-current motors. The alternating-current system of distribution has been considerably handicapped by the difficulty of obtaining variable-speed motors. He did not, however, claim that alternating-current, variable-speed motors are yet as satisfactory in every way as direct-current motors, but thought that the time was not far off when alternating-current motors with satisfactory variable-speed characteristics will be available. He urged in favor of the single-phase system of distribution that a central station was investing money needlessly if it runs three wires and uses two transformers for a motor customer who could be supplied with two wires and one transformer. The single-phase motor, with a starting rheostat, if started as a repulsion motor, takes less current from one phase of a polyphase circuit in starting than a polyphase motor with squirrel cage rotor would take from each of the three phases. Attention has recently been called to the variable speed motor made by the Wagner Electric Manufacturing Company, furnished in sizes from ¼ to 15 horse-power for 60-cycle circuits. The motor is built to operate as a repulsion motor, and may be wound for reversible or non-reversible operation. The stator is of the regulation induction-motor type made up of laminated sheet steel punchings assembled in a rigid cast-iron frame. The armature, which is wound with a progressive wave winding similar to the usual winding on direct-current armatures, has a commutator with four brushes, short-circuited on each other. This motor operates as a repulsion motor, and with a given load the speed of the motor depends entirely on the voltage supplied to the field terminals. To obtain lower speeds a reduction of voltage may be accomplished either by a rheostat or by an auto-transformer. A speed reduction of at least 50 per cent and in many cases more, can easily be obtained with satisfactory operation. They are not suited to conditions where there is a great variation in the load on the motor. Where load conditions are constant, such as in the operation of printing presses, blowers, pumps, conveyors and refrigerating plants, they could be very satisfactorily employed.

The discussion of this paper drifted into a question of methods of changing customers' motors from a direct-current system to single-phase, alternating-current. Mr. O. M. Rau said that in Racine such a change had been made, and in one case where a customer had a number of direct-current motors, a motor-generator was put in. A year previous to the time the company anticipated making the change it informed everyone that such a change was contemplated. This prevented new customers purchasing direct-current motors, who were taken care of temporarily by the loan of direct-current motors. When the time came to make the change, the company announced that it would give the present market price for the direct-current motors and allow this on the price of the new single-phase motors. It took about three years to make the change, the company being very accommodating in its policy, and careful to meet the wishes of customers.

New Telephone Patents.

TRANSMITTERS.

A number of different designs have from time to time been developed for double-acting transmitters. These have been of various types, the simplest of which uses two diaphragms acting upon a single microphone button. Both electrodes are movable, each associated with one diaphragm. The sound passages are so designed that the two diaphragms will approach and recede in synchronism. In Fig. 1 is shown in section such a double diaphragm transmitter patented by H. P. Clausen, of Chicago, his patent being assigned to the American Electric Telephone Company. The electrodes are suspended upon auxiliary mica diaphragms and are secured to the main diaphragms. The operation is self-evident from the foregoing.

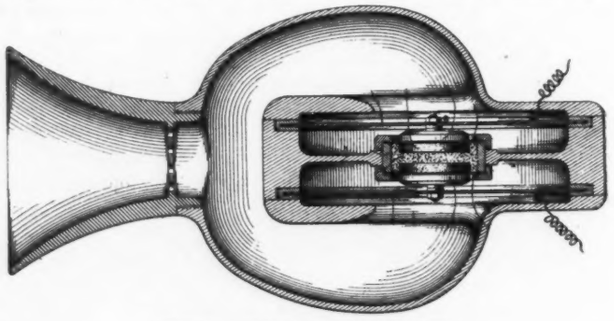


FIG. 1.—CLAUSEN TRANSMITTER.

Some time ago we noted a hand microphone type of instrument in which the microphone button is mounted upon an angle with the main diaphragm with a view to preventing the electrode faces from approaching too close to the horizontal in any position of use. It has been found difficult to shape the bent spindle required for connecting the diaphragm and the movable electrode so that it can be clamped solidly to the diaphragm

without producing constant distorting strains. To overcome this, Mr. C. Umbach, of New York City, has patented an adaptation of the ball and socket joint to this purpose. The Western Electric Company is assigned the patent.

DICTATION SYSTEM.

There has recently been devised a scheme for facilitating dictation by the use of the telephone. A switching device is arranged so that any one of a number of stenographers may be signaled and who can respond through their individual telephone sets. A loud-speaking instrument is included in the set of the one giving dictation, so that the dictation may be read back as desired. Mr. J. W. Kelly, Jr., of Camden, N. J., is the inventor of this system. He has covered it by patents, the most recent of which has just been issued.

DESIGNATION PLUG.

The multiple switchboard had not long been in use before it was found necessary to provide special designations for the multiple jacks. For example, if a line be discontinued, it is necessary for a considerable time to indicate this fact to every operator having access to that line at any one of its multiple jacks. There are several other contingencies through which it becomes necessary to plug the lines. In recent years neat plugs

FIG. 2.—ADAMS SWITCHBOARD PLUG.

have been manufactured for this purpose, of distinctive colors to vary the significance. White is usually used for changed numbers, and ordinarily the new number is printed upon the designation plug.

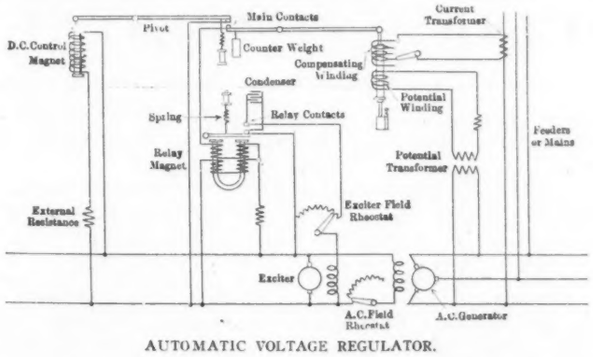
Such a designation plug is shown in Fig. 2, in position in the jack. The flat surface holds the plug from turning accidentally. Heretofore the head of the plug was maintained beyond the jack face to afford means of pulling the plug. In the present case the plug is made flush, but means are provided for forcibly turning it about its axis, whereupon the tension of the jack spring upon the sloping face rejects it. Plugs with this feature are covered by a patent granted to A. H. Adams, of Antwerp, Belgium, and assigned to the Western Electric Company.

LETTERS TO THE EDITORS.

Automatic Voltage Regulator.

To the Editors of Electrical World:

SIRS:—In your excellent digest of an article on the Automatic Voltage Regulator, appearing on page 150 of your issue of Jan. 18, I note you have copied an erroneous diagram appearing in the original and referred to in the digest as Fig. 1. In this diagram the shunt field rheostat is placed in *parallel* instead of in series with the field coils. It is evident that if



AUTOMATIC VOLTAGE REGULATOR.

the contacts of the regulator were closed the rheostat shunt coils and exciter armature would all be short circuited. I inclose a diagram which shows the correct connections of the regulator.

The author's conclusions as to the reasons for the close regulating properties are mainly correct. The spring system of the lever of the direct-current control magnet is shown in the diagram as a single spiral spring. In practice there are four springs distributed lengthwise on the lever arm and so adjusted as to give a uniform pull throughout its movement. The main contacts "float" up and down as they are acted upon by the magnets opposing the downward pull of the four spiral springs on the one arm and counterweight on the other arm, and it is this vertical movement of the floating contacts that gives the desired sensitiveness.

SCHENECTADY, N. Y. A. A. TIRRILL.

Measurement of Sound.

To the Editors of Electrical World:

SIRS:—In looking up some experiments in telephony, I note a remark in an editorial in your issue of June 16, 1906, page 1237, to the effect that "Sound can also now be measured precisely." We endeavored to do something of this sort by means of a telephone transmitter, and found that the effect varied greatly with the pitch of the sound and with the diaphragm of the transmitter. As we plan to continue these studies, I should highly appreciate a reference to further discussion of the subject. We have a quantity of data showing the current strength in the secondary circuit of a transmitter, varying with the pitch of a siren, and showing peaks or turning points at approximately octaves apart. This study was incidental to a study of the relative volumes of sound from telephone ringers, in the course of which we found that the effect upon a telephone transmitter was greatly affected by the character of the hammer. From the editorial remark I infer that others have been working recently on similar lines, and I should like to get in touch with their work.

UNIVERSITY OF MINNESOTA. GEO. D. SHEPARDSON.

Engineering English.

To the Editors of Electrical World:

SIRS:—There has been much discussion of late concerning the subject of engineering education. The subject has been treated broadly by some of the participants while others have gone into specific details, morals and mathematics, shop practice, classics, salaries and simplified spelling, everything seems to have been considered.

With this introductory explanation, I would offer a few remarks respecting a detail in engineering education which is self-evidently essential in all the schools but which seems to require continual repetition and emphasis. I refer to the matter of *exactness* of expression, particularly in writing.

I have had to examine a large number of reports, specifications, and other written productions of engineers, would-be and real, and have observed much that would serve for present illustration, but I am going to be so bold as to take my text from the very pages of the ELECTRICAL WORLD itself, realizing the risk of such temerity.

In the description of the new power station of the Fall River Electric Light Company, on page 175 of your current issue, the smoke and draft connections between boiler furnaces and stack are thus described:

"Each boiler discharges directly into the smoke header by a flue 4 ft. long. The header connections are arranged so that the hot gases can be discharged through the economizer to the stack direct or by way of the induced draft fan to the stack direct from the boilers, or through the fan; by division dampers gases from one battery may go through the economizer and those from the other direct, as may be desired."

Do the boilers really discharge into the smoke header? I will pass this over because the *meaning* is clear, merely remarking that we measure you, my dear Editors, by a high standard for which you are largely responsible.

But what of the rest? The word direct is so overworked that

it seems to mean direct and also various degrees of indirectness; in fact about every alternative path provided for the gases is described as being direct yet the word is used to differentiate these paths.

It would also appear that there is a difference between going "by way of the induced draft fan" and "through the fan," expressions that most engineers would consider synonymous. We are told, however, that the first provides a path "to the stack direct from the boilers," while the second is some kind of alternative thereto.

Now here is much unnecessary confusion in the description of a simple matter and it is the kind of thing likely to be fatal to the career of an engineer and that many, if not most, men are apt to fall into unless they have been thoroughly drilled in the matters of exactness and clearness of expression. The young man who has grasped that fundamental requirement of exact and clear expression will be the more thorough student and, in after life, he is not unlikely to pass men of greater natural abilities because he can write a better report.

New York. F. V. Henshaw.

[The criticism of Mr. Henshaw is well founded, both with respect to engineering English in general and the example quoted in particular.—Eds.]

The Rolling of Thunder.

To the Editors of Electrical World:

Sirs:—Referring to Mr. Groat's article in the issue of Jan. 11 describing a very interesting thunder phenomenon which he had the good fortune to observe, it must be remembered that the echo of a thunder clap will, in general, differ in time from the sound which reaches the observer direct from the flash.

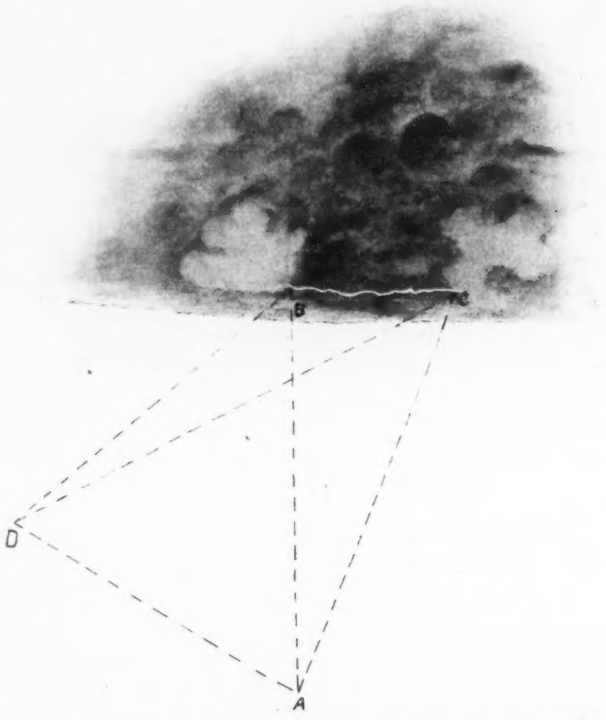
Referring to the accompanying illustration, it will be seen that with respect to the sound which reaches the listener direct from the flash, there are practically the same conditions in regard to relative effect as in the first case treated in my article in your issue of Dec. 21, and represented by Figs. 2, 3 and 4.

In the case of a flash composed of a large number of discharges, where the position of the flash is such that the beginning and end are at nearly the same distance from the observer, the sound would be of short duration, would increase very rapidly to a maximum, and then die out very quickly. The sound might be said to be similar to that of an explosion.

In the case of the echo, the relative positions would be represented by *BCD*, which correspond to Fig. 5 of the original paper. The sound would be similar to that represented in Fig. 7. It would not be so loud as in the previous case, but would be more prolonged.

If the point of observation is immediately under the middle point of a flash from cloud to cloud, so that the ends are practically equidistant from the observer, the explosive character of the sound would be a maximum; the passage of the discharge from cloud to cloud being practically instantaneous, the sound from the middle point would reach the observer first, and there would be practically the same sound that is produced where a discharge takes place from the middle point to each cloud.

Variety in nature is well illustrated by thunder and lightning. Although the principles which underlie the rolling of thunder are simple, great care must be exercised in noting details in regard to the flash itself, the distance of its ends from the point of observation, the distance of the points or reflection from the ends of the flash, and from the point of observation, and any-



RELATIVE POSITIONS OF FLASH, OBSERVER AND POINT OF REFLECTION.

thing that would modify the sound. With these data the curves of the direct and reflected sound can be plotted, and by combining these the curve of sound can be obtained.

If in the case cited above the point of reflection was at such a distance that the echo did not reach the observer till the sound which came direct from the flash had ceased, the echo would have been entirely distinct and different from the latter. If the echo from one part of a flash reached the listener before the sound which came direct, the echo would be superimposed upon the latter.

Schenectady, N. Y. D. S. Carpenter.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Transformation from Three-phase to Single-phase.—W. S. Moody.—In a single-phase system the power delivered changes from maximum to zero and back to maximum every half cycle, while in a polyphase system the power delivered is constant. Therefore, any system, if it be capable of transforming from balanced polyphase current to single-phase current, must be capable of storing up energy during the interval of time when the power delivered to the single-phase side is less than the power received from the three-phase side. This is evidently impossible to accomplish by means of static transformers. One plan of using static transformers which has been suggested is to have three transformers, two connected in open delta and the third in reverse delta arrangement to the other two. It is shown with the aid of diagrams that this whole combination is simply equivalent to a single transformer across one or two phases of the supply.—*Gen. Elec. Rev.*, January.

Single-phase Commutator Motors.—M. Osnos.—A continuation of his analytical comparison of the behavior of the different types of single-phase commutator motors with special reference to traction purposes.—*Elek. Zeit.*, Jan. 9.

Resonance Transformers.—J. Bethenot.—The conclusion of his long theoretical discussion of the resonance transformer and those special points which are to be taken into account in its design.—*L'Elec. Electrique*, Dec. 28.

Rotary Converter.—E. J. Berg.—The first parts of what appears will become a long serial on the theory of the rotary converter.—*Gen. Elec. Rev.*, January and February.

Induction Motors.—R. GOLDSCHMIDT.—A continuation of his long serial on the leakage of induction motors. In the present installment the author discusses the leakage of the coil ends.—Lond. *Electrician*, Jan. 17.

Lamps and Lighting.

Commercial High-Efficiency Lamps in Europe.—The following data collected from the advertising pages of the last issue of the leading German electrical journal give a summary of the high-efficiency lamps now on the market in Germany, and the claims of the manufacturers:

	Watts per hefner cp.	Life in hours	Voltage and hefner cp.
Bergmann "metallic-filament lamps."	1	1000	up to 130 volts, 25, 32, 50, 100 cp
"Metallized carbon" lamps	2½	500	100 to 120 volts, 16, 25, 32 cp
Hollefreund zirconium lamps	1	500 to 1000	"up to 220 volts," no cp given
Welsbach "osram" (tungsten) lamps	1	not given	100 to 130 volts, 25, 32, 50 cp 200 to 250 volts, 40, 50 cp
Siemens-Halske tantalum lamp	1.5 to 1.7	800 to 1000	50 to 60 volts, 12 cp 65 to 75 " 12 " 100 to 120 " 16 " 65 to 75 " 25 " 100 to 120 " 25 " 140 to 160 " 25 " 65 to 75 " 32 " 100 to 120 " 32 " 140 to 160 " 32 " 100 to 120 " 50 " 140 to 160 " 50 "
Pintsch "Sirius-Colloid" lamp (Kuzel patents)	1	not given	up to 130 volts, 25 cp and more

The new "quartz lamp" (recently described in detail in ELECTRICAL WORLD from a paper of Busse), which is a mercury-vapor lamp with a quartz tube in a glass globe, is also now on the market. In its general appearance it resembles an arc lamp. It is to be used as a single lamp at 220 volts and has a candle-power of 3000 hefner candles, consuming 0.25 watt per hefner candle-power. The life is 1000 hours, and an advantage over the arc lamp is that it is not necessary to replace any electrodes. The Beck lamp (an "intense flame arc lamp without any regulation mechanism") is sold for candle-powers from 2400 to 30,000.—*Elek. Zeit.*, Jan. 16.

High-Voltage Incandescent Lamps.—C. HEIM.—In an article on the best voltage for distributing net-work the author discusses the difficulties of making 220-volt lamps. The first 220-volt carbon-filament lamp appeared in England in 1897, and this type was placed on the market in Germany in 1898, but its well-known disadvantages (higher specific power consumption and shorter useful life than in the case of 110-volt lamps) have remained almost unchanged. These are in fact inherent disadvantages, since for the same candle-power and at the same temperature the carbon filament must have the same surface, but about four times the resistance for the double voltage. If the length of the filament is doubled, the cross-section must be made one-half or the diameter must be reduced to about seven-tenths of its former value. The thin filament cools more than the thicker filament for 110 volts, since the factor which determines the cooling loss is the ratio of surface to volume (or of circumference of cross-section to its area). More energy must therefore be supplied to the 220-volt filament in order to maintain it at the same temperature than for the 110-volt lamp. As a matter of fact ordinary 220-volt lamps of 25 or 16 hefner candle-power consume 3¾ watts to 4 watts per hefner candle-power against 3 1-3 to 3½ for 110-volt lamps. Further, with a thinner filament any irregularity of cross-section or structure shortens the useful life to a greater extent than with the thicker 110-volt filaments. With metallic-filament lamps the conditions are even more unfavorable. In order to make a 110-volt filament for from 25 to 32 hefner candle-power, its length must be brought to about 60 cm. and its thickness must be reduced to about 0.05 mm. The mechanical difficulties have been overcome, but naturally the cost of making the lamps is greater. It is fortunate that osmium, tantalum and tungsten do not vaporize or disintegrate at the high temperatures at which they are used, so that they have a long, useful life. The problem of making 220-volt metallic-filament lamps for 32 or less hefner candle-power offers such enormous technical difficulties that the author thinks that they will never be overcome. For candle-powers such as used by most consumers the author thinks it will be impossible to make 220-volt metallic-filament lamps (see also the abstract on 2 x 110 versus 2 x 220 volts under Installations, Systems and Appliances).—*Elek. Zeit.*, Jan. 9.

Mechanical Equivalent of Light.—C. V. DRYSDALE.—A Royal Society paper on an experimental determination of the mechanical equivalent of light. The method employed was to separate the visible and non-visible radiation by means of a prism, and to use a bolometer for measuring the energy. The value of 0.12 watt per candle-power for the white light from the Nernst filament agrees almost exactly with the value found by Angström for the hefner lamp. For an arc lamp the value found was 0.08 watt per candle-power for white light. The conclusion arrived at is that with 100 per cent efficiency an ideal source of white light should give about 10 candles per watt, and a monochromatic yellow-green source about 17 candles per watt.—*Proc. Royal Soc.*, Dec. 9; Lond. *Electrician*, Jan. 17.

Arc Lamp.—G. N. CHAMBERLIN.—An illustrated description of a 220-volt to 250-volt direct-current enclosed arc lamp, specially designed for the very severe operating conditions met with in the case of the nominal 220-volt motor circuit, generally used in iron and steel mills, with its greatly varying potential and the other disadvantages of high temperature, extreme vibration and the presence of large quantities of fine metallic dust.—*Gen. Elec. Rev.*, January.

Luminous-Arc Headlamp.—G. N. CHAMBERLIN.—An article illustrated by diagrams on the use of the magnetite arc for street-car headlamps.—*Gen. Elec. Rev.*, February.

Power.

Electric Cranes.—H. H. BROUGHTON.—A continuation of his long illustrated serial on electric cranes. In the present installment the author deals with mechanical brakes fitted with electromagnetic release and describes a brake made by a British company in which the magnetic pull required to release the brake is obtained directly from the motor field flux itself. Alternating-current, brake-releasing electromagnets are then dealt with, and a brief description of motor-brake magnets suitable for single-phase and polyphase equipments is given.—Lond. *Electrician*, Jan. 17.

Electric Power for Printing.—F. E. VICKERS.—An illustrated description of a printing-press equipment with push-button control, suitable for large printing presses and used in the printing plant of a San Francisco newspaper.—*Gen. Elec. Rev.*, January.

Niagara Falls.—G. R. SHEPHERD.—An illustrated description of the power station of the Niagara Falls Hydraulic Power & Manufacturing Company.—*Gen. Elec. Rev.*, January.

Coke Extractor.—M. R. CLARKE.—An illustrated description of an electric apparatus for drawing coke from beehive ovens and loading the coke into a car.—*Gen. Elec. Rev.*, February.

Electricity in Mines.—F. A. BARRON.—The first part of an article giving notes on wiring and wiring-supplies for mining service.—*Gen. Elec. Rev.*, February.

Steam Turbines.—W. L. R. EMMETT.—A discussion of the steam turbine with special reference to the Curtis turbine, and with comparisons with the reciprocating engine.—*Gen. Elec. Rev.*, January.

Traction.

Electric Railways in Switzerland.—S. HERZOG.—A summary of progress made in the erection of electric railways in Switzerland during 1907. The electric operation of the Simplon tunnel has continued to be perfectly satisfactory. Traffic has increased in the tunnel and new and stronger locomotives have been installed. On the single-phase, 15,000-volt road from Seebach to Wettingen the period of experiments is over and it is now regularly operated on schedule time. The last troubles which were experienced, due to the induction on telephone

lines in the neighborhood, have been finally overcome. A typical example of a high-tension, direct-current light railway is the Mesocco road from Bellinzona to Mesocco operated with direct-current at 1500 volts, there being four 66-hp motors, two 750-volt machines being connected in series. The single-phase, 5000-volt road from Locorno to Bignasco has been opened. The trolley wire is at the side of the road. The cars are equipped with motors having a total rating of 160 horse-power, which are fed with low-tension current from transformers placed on the cars. During the months in which this road has been in operation this single-phase road has given better economical results than direct-current roads, and also shows advantages with respect to first cost. It is concluded that the single-phase system has a promising future for interurban roads. Some statistical data on older electric railways in Switzerland are also given.—*Elek. und Masch.*, Jan. 12.

Single-phase Traction.—Henry.—The first parts of an illustrated article on single-phase traction on European railroads. The author describes the methods of the Oerlikon Company and the equipment of the Seebach-Wettingen line.—*L'Electricien*, Jan. 4 and 11.

Railway Power Station Capacities.—E. E. Kimball.—An article illustrated by diagrams and tables in which the author outlines briefly the general procedure followed in preparing estimates on the power required for the operation of proposed trolley roads and also presents some data in connection with train resistance and energy consumption.—*Gen. Elec. Rev.*, January and February.

Railway Signals.—F. B. Corey.—The conclusion of his illustrated serial on railway signals. In the present installment signal mechanisms which drive the semaphore arm are discussed and illustrated.—*Gen. Elec. Rev.*, January.

Switch Indicator.—F. B. Corey.—An illustrated description of a new switch indicator for use in connection with automatic railway signals.—*Gen. Elec. Rev.*, January.

Motor Cars.—A. Solier.—An illustrated description of the new motor cars of the General Tramway Company of Paris.—*La Lum. Elec.*, Jan. 4.

Parks and Tramways.—This issue contains a great many articles on the management and equipment of parks and pleasure resorts in connection with electric railways.—*St. R'y Jour.*, Jan. 25.

Installations, Systems and Appliances.

2 x 110 Versus 2 x 220 Volts.—C. Heim.—In England and Continental Europe it has become the fashion to build three-wire plants for 2 x 220 volts even in such cases where it would be possible to get along with 2 x 110 volts. This causes much trouble now after the low-voltage, high-efficiency, metallic-filament lamps have become available. The author does not think that a 220-volt, 16-cp, metallic-filament lamp will soon be placed on the market (see the abstract under Lamps and Lighting). In the design of a plant, and especially of a municipal plant, the interests not only of the producer but also of the consumer should be taken into consideration. The advantages of 2 x 220 volts are nearly all gained by the producing station. The consumer is only interested in the same as far as it is possible to lower the costs somewhat on account of the lower cost of the distributing network. Under average conditions, with equal extension of the network and equal load, however, the total cost of the plant is only 15 per cent less for 2 x 220 volts than for 2 x 110 volts, if the wires are placed overhead, and in case of underground cables it is only 10 per cent less. Although users of electric motors derive all the advantages of the lower cost of energy generation, the lamp user has almost no profit from it. The chief advantage of 2 x 220 volts is the possibility of extending the distributing network much further than with the lower voltage. Much, however, may be achieved by simply raising the supply e. m. f. from 110 to 120 or 130 volts. With alternating-current networks it is, of course, possible to connect 110-volt lamps to a 220-volt supply by using sub-divided inductance coils. In the case of direct-current it is possible to employ a battery and connect the low-voltage lamps to a suitable number of cells. Since the battery need not supply energy it is sufficient to use simple lead plates instead of formed ones, which, however, would be advantageous only in special cases. With the 110-volt metallic-filament lamps, which are very much less sensitive with respect to voltage variations than carbon-filament lamps, it is not necessary to be so careful in limiting the permissible voltage drop, and for this reason an extension of the network beyond that permissible with carbon-filament lamps is possible. For the same reason the voltage drop permitted in house installations could be increased from 2 per cent to 3½ or 4 per cent. While the saving of cost is rather insignificant, yet it might lead to the practice of selecting the wire in house installations simply with reference to mechanical strength without taking the voltage drop into consideration. Changes in the regulations concerning fuses should also be made. The general conclusions of the author are as follows: In selecting the supply voltage of municipal electricity stations the interest of consumers should be more considered than heretofore. New plants for cities of not over 30,000 inhabitants should be designed for 2 x 110 or 2 x 120 volts and not more. Even in larger cities up to about 50,000 inhabitants it should be endeavored to get along with the low voltage even if some people at the outskirts of the city must be neglected. An exception must be made in those cases in which a heavy motor load is found in the outskirts of the city. If in cities of 50,000 or more inhabitants the generation of direct-current is desired, 2 x 220 volts must be chosen. In case of high-tension alternating-current transmission with converter stations for direct-current distribution, the lower e. m. f. of 2 x 110 volts is not as economical as the higher voltage, but in cases of alternating-current transmission with distribution from transformer sub-stations the lower voltage should be chosen. In isolated plants the two-wire system at 110 volts or the three-wire system at 2 x 110 volts should by all means be selected.—*Elek. Zeit.*, Jan. 9.

Troppau.—O. Armknecht.—The conclusion of his illustrated article on the station of the City of Troppau supplying energy for lamps, motors and railways. This city has 30,000 inhabitants and it is shown that in this case the three-wire, direct-current system was the most economical one. The tramway is operated at 550 volts.—*Elek. Zeit.*, Jan. 9.

Wires, Wiring and Conduits.

Cellulose Acetate Covered Wire.—R. Fleming.—As a substitute for silk or cotton cellulose, acetate and enamel have proven to be well adapted to the insulation of copper wires. The mechanical properties of the cellulose acetate film make it desirable for use with very fine wires, from 0.003 in. in diameter or even finer to as much as 0.005 in. For larger sizes the

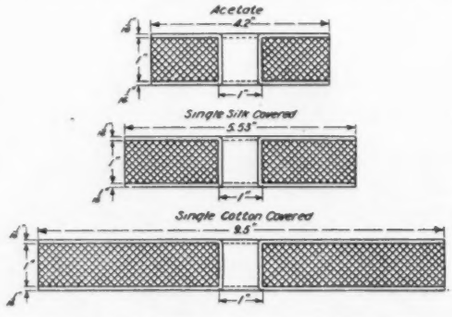


FIG. 1.—CELLULOSE ACETATE COVERED WIRE.

enamel coatings are more suitable. The following tabulation shows some of the more important comparisons of data for a wire .003 in. in diameter:

	Acetate.	Single Silk.	Single Cotton.
Thickness of insulating film....	.0005	.0009	.00175
Wire space factor.....	.442	.313	.167
Wt. per thousand feet (lbs.)...	.033	.036	.049

For a given number of turns on a given form, the mean length of turn and the total length of wire is greatly reduced. This is clearly shown by the diagrams drawn to scale and given in Fig. 1, which relate to a diameter of spool 1 in., length

of spool 1 in. and 100,000 turns with 0.003 in. diameter of copper. Another great advantage of acetate-insulated wire is that it is not affected by ordinary atmospheric conditions. It seems particularly suitable for telephones and other specialties in which the fine wires are used. The copper wire is covered with an acetate film in automatic coating machines.—*Gen. Elec. Rev.*, January.

Electrophysics and Magnetism.

Electric Waves.—W. R. BLAIR.—A paper on the change of phase due to the passage of electric waves through thin plates and the index of refraction of water for such waves, with applications to the optics of thin films and prisms.—*Phys. Rev.*, January.

Discharge of Electrodes.—J. G. DAVIDSON.—An account of an experimental investigation of the conditions affecting the discharge of electrodes in phenomena of ionization.—*Phys. Rev.*, January.

Electrochemistry and Batteries.

Electrometallurgy of Iron and Steel.—J. W. RICHARDS.—The conclusion of his Franklin Institute paper on the electrothermic production of iron and steel. The author gives the thermochemistry of a special case of iron reduction in the electric furnace and discusses the experiments with the Héroult furnace, made at Sault Ste. Marie. He emphasizes that it is important to use no more carbon than is necessary for reduction. —*Jour. Franklin Institute*, January.

Electrometallurgy of Iron and Steel.—S. A. TUCKER.—The first part of a general discussion of the subject. The Héroult steel furnace and the automatic regulator used in connection with it are described. The author then discusses the Héroult process for iron ore reduction.—*Gen. Elec. Rev.*, February.

Fused Salts.—H. M. GOODWIN AND R. D. MAILEY.—The conclusion of an account of their extended investigation on the density, electric conductivity and viscosity of fused salts and their mixtures. The results are given in tables and diagrams. One of the general results is that the specific conductance of fused salts is not strictly proportional to the temperature, but increases less and less rapidly as the temperature rises. The temperature resistance coefficient is, generally speaking, less than one-fifth as great as that for the corresponding aqueous solutions.—*Phys. Rev.*, January.

Units, Measurements and Instruments.

Induction Meter.—An official report of the Reichsanstalt by which the induction meters of the Allg. Elek. Ges., described as follows, are admitted for official calibration and certification. The meters are built for e. m. fs. up to 250 volts and for currents of 3, 5, 10 and 15 amperes in two-wire and three-wire alternating-current systems. They may also be used in

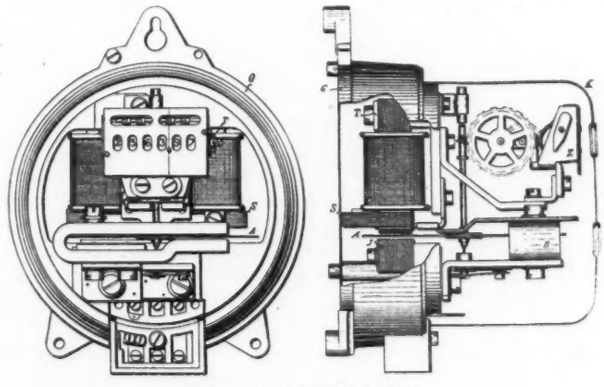
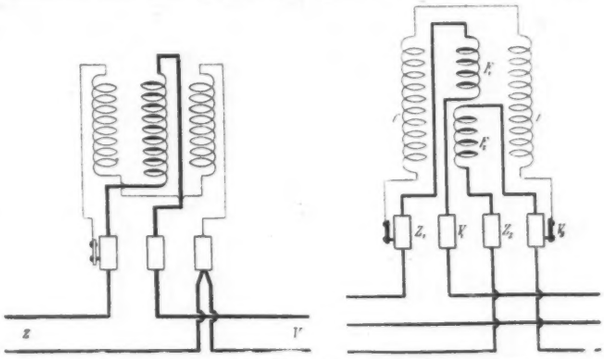


FIG. 2.—INDUCTION METER.

balanced three-phase systems. The meter, the construction of which is shown in Fig. 2, consists essentially of a two-phase induction motor, a magnetic brake *B* and a counting device *Z*. The rotating member of the induction motor is an aluminum disc, while the inducing member is a three-legged iron core *T* above the disc and the yoke *J* below the disc. The two outer legs of the iron core *T* are wound with the shunt coils, while the series coil is placed on the shorter middle leg. For the two outer legs a magnetic shunt is provided. In the shunt coils a current is produced which is about 80 degs. behind the voltage of the network. The current flux and the voltage flux are brought into exact quadrature by means of a piece of iron fixed on the cast-iron plate *G*. The free end of this iron piece extends into the air space between the middle leg and the aluminum disc and is provided with a short-circuited copper



FIGS. 3 AND 4.—DIAGRAMS OF METER CONNECTIONS.

ring. The torque exerted on the disc is proportional to the current, the voltage and the cosine of the time phase difference. The energy is consumed by the eddy currents generated in the aluminum disc by the braking magnet *B*. The connections for two-wire meters are shown in Fig. 3 and the connections for three-wire meters in Fig. 4. Instructions as to calibration are given.—*Elek. Zeit.*, Jan. 9.

Cadmium Cells.—H. S. CARHART.—Evidence has recently been adduced by Heulett tending to the conclusion that the chemical stability of the Weston or cadmium cell is inferior to that of the Clark. The present author shows that whatever may be the fact as to lack of stability in the case of cadmium cells made with electrolytically prepared mercurous sulphate, his old cells made with precipitated mercurous sulphate meet every requirement of permanency. They are fully the equal of the Clark cell in this regard, and are decidedly superior when considered from the point of view of the permanency of the containing glass cell.—*Phys. Rev.*, January.

Photometry.—F. LAPORTE.—A very long and full account of the tests of the International Photometric Commission at the meeting in Zurich last year on photometric units. The decisions have already been summed up in the Digest.—*L'Eclairage Elec.*, Dec. 28.

Telegraphy, Telephony and Signals.

Slightly-Damped Electric Oscillations.—M. WIEN.—The author formerly described a peculiar kind of "coupled oscillations" which are produced in two closely-coupled systems, if the primary is excited by means of a very short hissing spark gap. The two theoretical "coupling waves" were found to have only a low intensity while a third oscillation manifested itself more strongly, corresponding to the frequency of the uncoupled secondary system. This third oscillation was only slightly damped. Some further experiments on this phenomenon are described and the application to wireless telegraphy is suggested.—*Phys. Zeit.*, Jan. 15.

Directed Wireless Telegraphy.—J. ZENNECK.—An article on the use of partly horizontal antennas for wireless telegraphy in a predetermined direction. The author endeavors to give an approximate mathematical theory of the manner in which such an antenna acts on the receiving station.—*Phys. Zeit.*, Jan. 15.

Miscellaneous.

Electric Cooking.—E. L. CALLAHAN.—Illustrated notes on the use of electricity in the kitchen and the advisability of central stations making exhibits and demonstrations in order to attract customers for electric cooking.—*Gen. Elec. Rev.*, January.

La Lumière Electrique.—The French journal L'Eclairage Electrique has assumed, with the beginning of the year, the old name *La Lumière Electrique*, which it had up to 1894.

BOOK REVIEWS.

Electrical Engineering. By Dr. Adolf Thomälen. Translated from the German by Geo. W. O. Howe. New York: Longmans, Green & Company. 456 pages; 454 illustrations. Price, $4.20 net.

This excellent treatise covers in a masterly manner the whole range of electromagnetic phenomena usually taught to students of electrical engineering in high-grade colleges. Starting with the elementary principles of electrophysics and electrochemistry, and stating Ohm's law in its simplest terms, the author leads the student into the involved electromagnetic relations in dynamos by way of the most easily traveled routes. The actual details of machines as practically constructed are discussed merely to the limited extent necessary to show the application of the principles being explained.

In view of the excessive work that the word "induced" is compelled to perform in electrostatics and electromagnetics, it seems unfortunate that the translator should have burdened it with the task of serving as a synonym for "generated" in the description of the production of e. m. f. by causing a wire to traverse a magnetic field. The explanation of the operation of a stationary transformer is remarkably clear and accurate. The discussion of the parallel working of alternators is equally as good, and the phase-swinging of alternators is treated in an instructive manner.

The treatment of the polyphase induction motor is good, but the fact that there are given 11 different circle diagrams, not one of which is claimed to be accurate, and all of which are unnecessarily complicated, would indicate that there is room for considerable improvement in this portion of the book. The treatment of the single-phase induction motor is somewhat more satisfactory; it is based on the resolution of the flux and the m. m. f. into two fluxes and two m. m. f.s rotating in opposite direction. The resolution of the flux was proposed by Ferraris, but Dr. Thomälen introduced the resolution of the m. m. f.s. The method used is somewhat artificial, but the results obtained accord with the known facts. Single-phase commutator motors, synchronous converters and motor-converters are discussed briefly.

In an appendix, an outline is given of the symbolic method of solving alternating-current problems. Throughout the whole book the author keeps closely in touch with physics, and never allows mathematics to lead him astray. Although making no studied attempt to avoid mathematics, he has used mathematics merely to express physical relations, rather than physics to interpret mathematical equations, and has succeeded in producing a book that will be welcomed alike by the student and the instructor in electrical engineering.

Hilfsbuch fur der Elektrotechnik. By Dr. Karl Strecker. Berlin: Julius Springer. 1023 pages; 675 illustrations. Price, 14 marks.

This hand-book is divided into three parts dealing with the general physical, magnetic and electrical properties of materials and apparatus, with the testing of materials and apparatus, and with the design features and performance characteristics of stationary and rotary transformers, direct-current and alternating-current generators and motors, primary and secondary batteries, transmission systems, electric lighting and electric railway circuits. Wireless and wire telegraphy and telephony, electrochemistry are also treated. The book, which is now in its seventh edition, has been revised and rendered thoroughly accurate and up-to-date by the staff of 24 specialists who have been associated with Dr. Strecker. Moreover, much valuable material has been included in the book by reason of the friendly assistance of manufacturing companies.

Handbuch der Angewandten Physikalischen Chemie. Part 6. Ein fuhring in die Phasenlehre und Ihre Anwendungen. By Dr. Alex. Findlay. Leipzig: Johann Ambrosius Barth. 224 pages, 134 illustrations. Price, 10 marks.

This is a translation of Dr. Findlay's well-known English work, made by Prof. G. Siebert, of Wiesbaden. It is indeed strikingly illustrative of the cosmopolitanism of science that the acknowledged author of the phase rule was Professor Gibbs, of Yale, the treatise under discussion, based on Gibbs' deductions, was written by a professor in Birmingham, England, and now the German-reading scientific world gets inspiration and help from this translation. It is with pardonable pride that we see Gibbs acknowledged as the founder of this most general law of chemical dynamics, a law independent in its applications of any hypothetical or even theoretical assumption as to the constitution of matter, a veritable master key to chemistry and physics. May our German colleagues, with the help of this work, add mightily to the development and applications of the phase law of Gibbs.

Impianti Elettrici a Correnti Alternate. Semplici Bifasi e Trifasi. Second Edition. By A. Marro. Milano: Ulrico Hoepli. 774 pages, 347 illustrations, 71 tables. Price, 6.50 lire.

This handy volume has been revised and enlarged in its second edition. It contains a number of useful tables for service in electrical engineering, so that the book is a sort of cross between a text book on alternating-current installations and an engineer's pocket-book. The first three chapters deal with the elementary theory of alternating currents. Following chapters discuss respectively, industrial measuring instruments; alternators; transformers; synchronous motors; commutating motors; asynchronous motors; alternating-current lamps; distributing systems; conductors; construction of plants; economics of construction and operation; alternating-current traction. The two final chapters are on rules and regulations. The book is clearly written by an engineer for engineers, and will be welcomed by engineering students as well as all who are interested in modern Italian methods of constructing and operating electric installations.

O Concurso da Viacao Americana. (The American Street Railway in Oporto.) By Bernardo Lucas. Porto: Typographia a Vapor da Empreza Guedes. 226 pages.

A Portuguese legal brief directed to the contention that the development of a street railway system in the city of Oporo by the municipality is in contravention of the franchise and privileges of the Railway Company of Oporto.

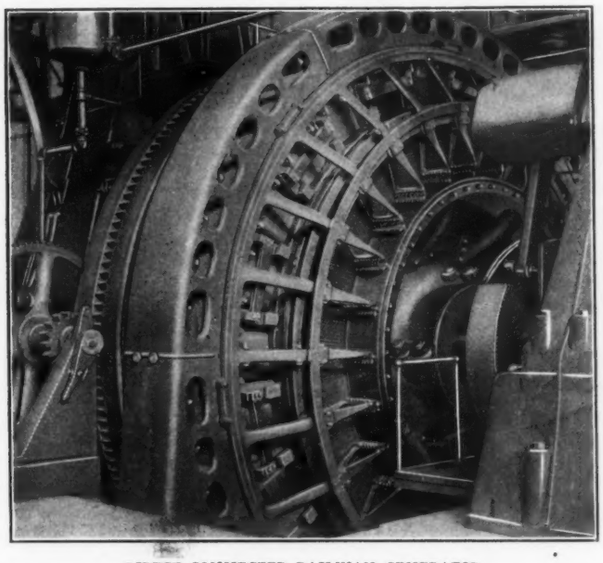
Commutating-Pole Generators in Station of Boston Elevated Railway Company.

Two 2700-kw commutating-pole generators, recently installed in the Charlestown and Harvard stations of the Boston Elevated Railway Company by the General Electric Company, present some interesting features in connection with the design, installation and operation of this type of railway generator. It is worthy of note that the armature diameter of these machines is about 4.5 ft. less than the armature diameter of the non-commutating-pole generators of the same rated output in the Lincoln way station of the Boston Elevated Company.

The commutating-pole generators are guaranteed to deliver full load continuously (4700 amperes at 575 volts) with a temperature rise not to exceed 35 deg. C., and to withstand a momentary overload of 100 per cent without injury. The practically sparkless commutation, which is secured under all of load by the use of commutating poles, reduces the wear of the commutator. No change whatever in the brush setting has to be made from no load to 100 per cent overload condition, and the circuit breaker can be tripped under any condition of load between these limits without appreciable disturbance at the brushes. In fact the provision for shifting the brushes is almost superfluous on this type of machine; with the brushes once adjusted for best commutation it is never necessary to alter their position. This desirable feature can be best appreciated by station attendants more or less accustomed, in times of excessive load or trouble, to the exercise of constant vigi-

lance with respect to the brush-setting on the ordinary type of generator, to prevent flashing.

While commutating-pole machines of moderate ratings have been in successful operation for some time past, it is only recently that this feature has been applied to large direct-connected engine-driven generators operating under the severe service conditions generally met with in street railway work. It is probable, however, that this type of machine will play an important part in the future in the economic consideration of problems relating to enlargements to or the building of new generating stations for the operation of street railways.



DIRECT-CONNECTED RAILWAY GENERATOR.

Automatic Storage Battery Control Apparatus.

In order to insure the maintenance of the level of the electrolyte in the pilot cell of a storage battery at the proper height, independent of the constant evaporation of water, the automatic cell-filling apparatus illustrated in Fig. 1 has recently been developed. The principle of the apparatus is the same as that of the ordinary float-controlled valve used in water tanks. Two sealed bulbs, which act as floats, operate the moving parts of the valve mechanism. A tube closed near its lower end, which is connected by a small rubber tube to the source of water supply, forms the support for the fixed member of the valve mechanism. When the level of the electrolyte is below normal, the valve opens. When the flow of water restores the level to normal, the moving member is raised and the valve closes, thus cutting off the supply until evaporation again lowers the level.

Fig. 2 shows a recording-signaling hydrometer which has been developed for automatically tracing on a chart a continuous record of the specific gravity of the pilot cell, and for signaling by means of a bell when the specific gravity reaches some predetermined point, on either charge or discharge. The fundamental principle of the instrument is that of measuring by means of a delicate balance the varying resultant weight of a bulb of constant volume totally immersed in the electrolyte. The bulb is hollow and made of glass, with a very small opening communicating with its interior. It is filled with electrolyte, and as change of temperature of the surrounding electrolyte causes expansion or contraction of that contained within the bulb, some of it is ejected or drawn in in such amount as to cause the weight of the bulb to change inversely with the temperature. To illustrate this point, suppose the temperature of the pilot cell to rise; this causes the electrolyte in the cell to expand and its specific gravity to decrease, and hence the buoyancy exerted on the hydrometer decreases and the instrument tends to sink lower. This is counteracted, however, by some of the electrolyte in the bulb being forced out, due to the expansion caused by the rise in temperature, and,

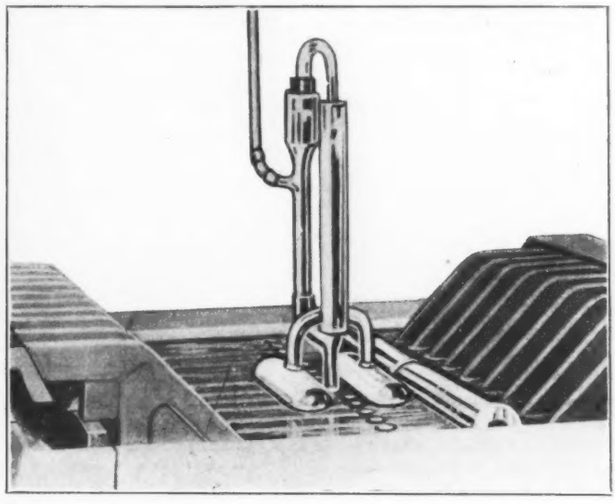


FIG. 1.—AUTOMATIC CELL-FILLING APPARATUS.

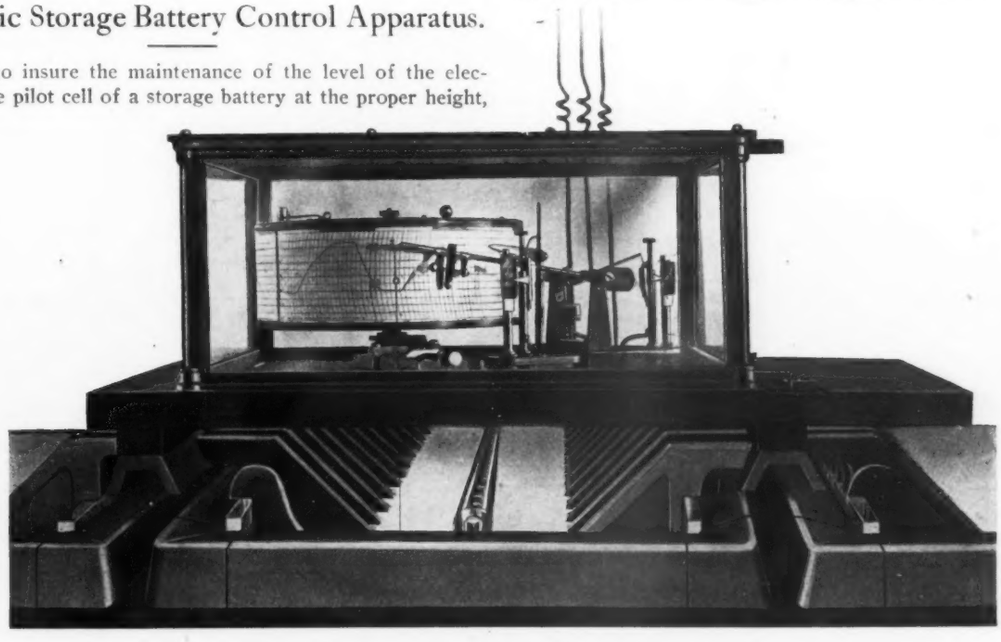


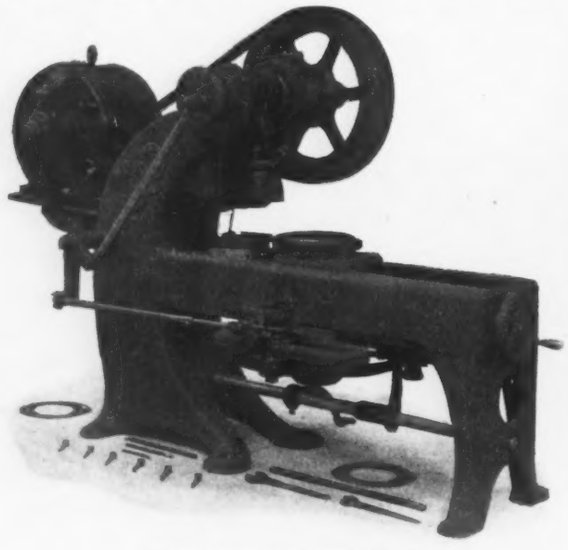
FIG. 2.—RECORDING-SIGNALING HYDROMETER IN SERVICE.

therefore, maintaining the bulb in the original position. The resultant weight, measured by the balance, is, therefore, independent of temperature changes in the electrolyte. The balance performs two functions: First by means of a pen it traces on a moving drum a record of the resultant weight of the bulb and hence of the specific gravity of the electrolyte, corrected for temperature change; second, by means of platinum mercury contacts, it closes a circuit which may be made to ring a bell.

Where it is not desired to obtain a continuous record of the specific gravity the apparatus can be arranged for merely indicating the specific gravity and for signaling, and the equipment becomes simplified by the omission of the recording devices. The above mentioned storage battery auxiliaries have been placed on the market by the Electric Storage Battery Company, Philadelphia, Pa.

Armature Disc Notcher.

The notching machine shown in the accompanying illustration is stated to contain the latest improvements in this class of presses. The various ratchets supplied can be quickly changed when required, although a given disc will afford a considerable range of indexing by varying the number of notches taken at each stroke. On the large gear is a tappet which, when the wheel has made one revolution, throws out the clutch and stops the machine, and when the wheel has been moved for a notch, a brake, operated by the same connection to the crank-shaft, prevents the gear from going beyond its proper position or overrunning when moving fast, and holds it still while the punch is descending; this brake enables the machine to be operated at a higher rate of speed than would be possible without it, up to 200 strokes on the smaller discs. The die-bed is adjustable vertically so that the die can always be set at the right height, and the depth of the notches can be accurately secured by means of the screw movement of the saddle upon the bed.



ARMATURE DISC NOTCHER.

This type of press is built by the Ferracute Machine Company, Bridgeport, N. J., in three sizes for notching discs up to 48 ins., 84 ins. and 120 ins. respectively in diameter.

Equipment of Japanese Hydro-Electric Plant.

The General Electric Company is furnishing complete electrical equipment for a hydro-electric plant in Nagoya, Japan, a city with a population of about 250,000, situated some 300 miles from Yokohama. The main generating station will be built at Yawozo, on the Naiko River, where power will be generated at 6600 volts by four three-phase, 2500-kw, 60-cycle, 360-r. p. m. waterwheel-driven generators. The generator voltage will be stepped up to the line voltage of 60,000 volts by 12 water-cooled transformers of 1000-kw capacity each, and transmitted 30 miles to the main sub-station just outside of the city of Nagoya. Here the line voltage is to be stepped down to 11,000 volts by nine water-cooled transformers of 1350-kw capacity each, and transmitted underground to the distributing station through triple conductor lead-armored cables, the city ordinances prohibiting an overhead transmission of over 3500 volts.

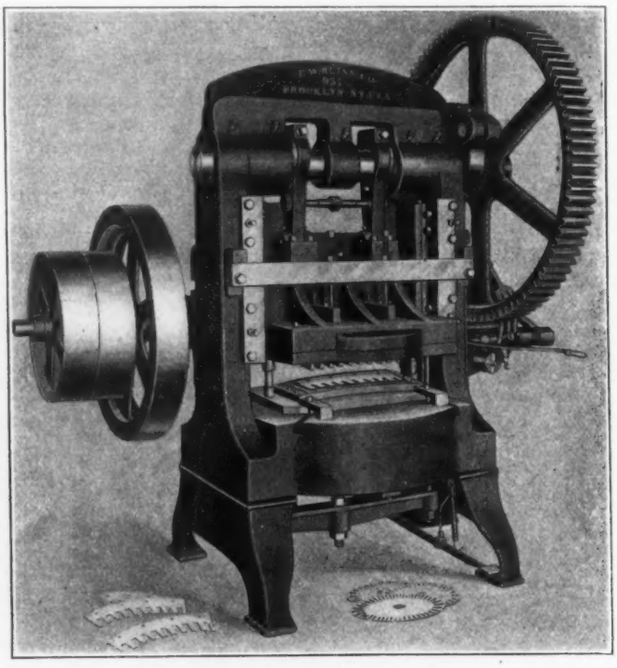
In the central distributing station the voltage will be stepped down to 3400 volts by nine water-cooled transformers of 1350-kw capacity each, at which potential it is to be distributed throughout the city by both overhead and underground cables.

It is interesting to note that from the nearest railway station the entire power apparatus for the Yawozo station will have to be transported on especially constructed wagons drawn by oxen.

The Naiko River is normally 40 ft. in depth, but in the rainy season the river often rises to 40 ft. and 70 ft. above low-water mark. This rising characteristic of the river necessitated the building of a specially designed dam to take care of the high water.

Armature Disc-Cutting Press.

In the accompanying illustration is shown an armature disc-cutting press geared as built by the E. W. Bliss Company, Adams Street, Brooklyn, N. Y. This press is designed for cutting simultaneously the outside and inside of plain discs up to 35¾ in. diameter, when the discs are not less than 3-in. wide, and up to 14 in. or 15 in. diameters when all the notches are to be cut at the same stroke. It may also be used for cutting segments or sections complete at one stroke. The illustration shows a die in position in the press for cutting segments, some of which are shown on the floor alongside, as also are some round armature punchings, which have also been made in this press. It is fitted with adjustable positive knockout devices for both the punch and the die. The slide is guided in adjustable ways of exceptional length and width so as to carry the expensive tools to be operated with perfect accuracy. Adjustment of the slide is effected by means of the Stiles eccentric adjustment, which enables the operator to raise and lower the slide quickly to the exact point required without any danger of disturbing the alignment. This type of press is built in several sizes.



ARMATURE DISC-CUTTING PRESS.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade was somewhat improved under the stimulus of more seasonable weather and a further increase in the percentage of active machinery. There is still a large number of hands unemployed, however, and retail dealers proceed cautiously in preparing for future business. Prices of commodities declined on the whole, yet products of the leading industries were fairly well maintained. Mercantile collections were irregular, despite the ease in the money market. There was little uneasiness regarding the additional bank closings, as it was realized that these suspensions were only the aftermath of the October panic and represented no new cause for alarm. Railway earnings in January were 15.3 per cent less than in 1907, and foreign commerce at the port of New York alone for the last week showed a gain of $5,466,915 in exports and a decrease of $4,669,690 in imports as compared with the same week last year. Returns of trade and industry during January show lessened sales and smaller output as compared with the previous January, the shrinkages being estimated at from 30 to 50 per cent. Iron output will probably be 50 per cent below that of a year ago, though perhaps larger than in December. The textile industries were quieter. The recent cuts of prices in cotton goods place the price of most grades at least 20 per cent below those of a year ago. Lumber and all kinds of building material were generally very quiet, despite some increase in lumbering operation. Pig iron continued quiet notwithstanding comparatively low prices. Official figures show that the output of pig iron in 1907 amounted to 25,781,361 tons, a new high record, and an increase of 1.9 per cent over the figures for 1906. At the close of 1907 there were 276 idle furnaces, as against 89 at the end of 1906. Little business has developed in bar iron, although prices are lower. During the week the leading iron and steel manufacturers decided to maintain prices. Finishing mills were a little more active but, on the whole, recovery is slow. New business in structural material was fair. Copper was firmer so far as the list prices of leading producers indicate, but there have been some resales at concessions, and therefore the actual market is probably easier. Excluding resale lots, business, domestic and foreign, is very light. Lake is quoted at 13¾c.; electrolytic, 3⅝c., and casting copper, 13½c. Business failures were fewer, the number as reported by *Bradstreet's* being 359 for the week ending Jan. 30, against 408 in the week previous, and 211 in the corresponding week last year.

PLANT FOR MEXICO.—The Compania Industrial Sabonera de la Laguna, in the town of Gomez Palacio, Mexico, has ordered from the Westinghouse Company an exact reduplication of the present electrical plant which the company installed a year ago. This plant is situated in the midst of the rich Laguna district which yearly produces more cotton than either Mississippi or Louisiana, and its output is soap, dynamite and cotton seed oil. In this part of the country water power is scarce and all the coal that is used must be imported from England in jute sacks at a cost of $16 to $18 gold a ton. About a year ago it was decided to discard steam and cut down operating expenses by using gas. An R. D. Wood gas producer was installed which fed a three-cylinder vertical, single acting Westinghouse gas engine of 200-hp capacity, direct connected to a Westinghouse 150-kw, 125-volt direct current generator, which operates the various motors in the shops from 50 hp down. The change from steam to electricity proved so successful that an exact reduplication of the plant has been ordered and shipped with a 300 R. D. Wood producer engine and a 250-hp generator. At present the plant employs between 400 and 500 men. In the same district where the Guayule plant, from which rubber is made, grows in abundance, the Compania Explotadora Coahuilense, a Mexican enterprise engaged in making rubber, has followed the example of the Sabonera Company and installed an electric system in its plant. The equipment consists of R. D. Wood producers, gas engines and four 100-kw and one 75-kw direct-current generators of 250 volts capacity, which operates all the motors in the works from 100 hp down. Direct and other connections are made to the rollers, crushers and other machinery used in manufacturing the rubber.

IN BRITISH WORKS.—A contract has just been awarded to the British Thomson-Houston Company, Limited, for the equipment of the rolling mill of Dorman, Long & Co., Limited, of Middlesboro, one of the most conservative steel-making concerns on the other side. The machinery to be installed will embrace a main mill motor, which will have a continuous capacity of 1200 hp and a maximum torque capacity up to no less than 3600 hp. For installation in the Mold Collieries large motors, designed for 500 volts, 50 cycles, three-phase, will be directly connected to turbine pumps, which will operate against a head of 600 ft. Another British contract is for the complete electrical equipment of the Moss-Hall Coal Company's underground workings, including the provision of the necessary equipment of a large generating station. This contract, which is said to be one of the largest of its description ever let on the other side, embraces several pumps of large capacity, motors, hauling gear, together with complete cable equipments for both surface and underground work. Among the orders secured for the equipment of British textile mills is one for 75 motors, ranging up to 170-hp capacity, for one of the largest plants in the Manchester district.

ARMY WIRELESS TELEGRAPH CONTRACT.—We are informed by the Massie Wireless Telegraph Company that the contract for the five sets of wireless telegraph apparatus for the U. S. Signal Corps, to which purchase reference was recently made in these columns, was awarded to that company. There were six bidders, on the same number of proposals, as follows:

Bidder No.	2 10-kw Sta. Equip. Each	2 sets wireless Equip. Each	2 10-kw Transf. Each	3 3-kw Conden. Each	3 3-kw Sta. Equip. Each	3 3-kw Tranf. Each
1....	$4,037	$4,137	$575	$159.60	$871	$325
2....	4,600				895	
3....			545			270
4....		2,480	490	130		249
5....	3,125	9,695	1,100			300
		7,175				530
6....	3,915	2,500	500	120	925	300

The final line gives the figures at which the contract was awarded to the Massie Company.

STANLEY METER SHOPS.—No great importance need be attached to the announcement that the Stanley Electric shops of the General Electric Company at Great Barrington, Mass., have closed down. Meters have been the output of the shop, but for the last year little work has been done there. The finished meters had to be sent to Pittsfield to be tested, and some time ago it was decided to make other arrangements. The closing of the shops is simply another step in the economic development of the company and has no bearing on financial or business conditions. At no time were more than 400 men employed at the Stanley works, and during the past year less than 100 employees have been at work there.

THE HAMILTON ANCHOR CO., of Hamilton, Canada, has purchased from the Atlas Anchor Co., of Cleveland, Ohio, the entire rights for Atlas anchors and setters in the Dominion of Canada. The Hamilton Anchor Co. was organized two years ago, and while it has met with flattering success with the line of anchors which it has been manufacturing, the Canadian rights of the Atlas anchor were acquired for the reason of the large surface and great strength of this type, which fit it for withstanding the highest strains.

SUPPLIES FOR EAST INDIES.—An American consul in the East Indies reports that a firm in that locality is in a position to do business in electrical supplies, and would like to correspond with manufacturers of electroliers, electric fans, etc. The current is alternating, 110 volts and 50 cycles. The address can be had from the Department of Commerce and Labor.

PLANT FOR ARGENTINE.—According to the Review of the River Plate, Buenos Aires, Argentine Republic, the La Plata Senate has approved in general the bill granting a concession to Messrs. Otto Franke & Co. for an electric railway between La Plata and Buenos Aires.

CURRENT BUSINESS CONDITIONS.—Mr. W. C. Webster, New York manager for the Westinghouse Company, sees much in the present situation to justify optimism. "The only criterion by which we can forecast the future state of the business world," he said last week, "is by observing the nature of the applications and inquiries which we are receiving from day to day. The nature of business inquiries of late have been very gratifying, for they indicate that the manufacturers and consumers who have been holding back for some time are now preparing to go ahead. Business has improved in a very marked manner during the last six weeks and I look for a good year. In fact, it is impossible for the recent stagnation to continue much longer. Light and power are being used as largely as they ever were and necessary repairs and extensions cannot be put off for much longer. The increasing activity of the business world will force into action, sooner or later, even the most pessimistic." The situation was summarized in a forceful manner by the head of one of the leading wire manufacturing concerns in the country, who said: "We are not going to have any such mad orgie of production as we have had for the last two or three years, nor, on the other hand, is the whole country going to the eternal bow-wows. In the end, after we all have had our say and we get down to tacks and figure up results for the year, we shall find that we have had a business year that will fall a trifle short of the normal business year." Mr. A. W. Burchard, of the General Electric Company, makes the subjoined interesting and encouraging remarks: "The character of the inquiries received from users of electrical apparatus since January first indicates that plans for extensions and improvements, which were suspended at the time of the acute financial crisis in October last, have been taken up and will be actively proceeded with. The diminished rate of business activity has already released and made available for investment a large amount of capital, which will in a little time clear the way for the new issues of securities which must be placed before constructive enterprises on a large scale can be proceeded with. This process is now progressing favorably. In the meantime, the managers of industrial enterprises will have the opportunity of giving adequate consideration to problems of operating economy and efficiency, subjects to which it has been impracticable to give the attention they should receive during the pressure for output under which most manufacturing concerns have been working during the past three years. The indications are that confidence in the future has been or is being rapidly restored and that the current rate of business represents the lowest mark which will be reached. From the present level conditions should gradually improve, and when the march toward prosperity has been resumed at full speed, the manufacturers generally will be in a much better position in respect to the efficiency of their plants and organizations and their facilities for economical operation than ever before."

CEMENT TRADE COMBINATION.—Announcement is made of the formation of an association of licensed cement manufacturers, which will include all the leading Portland cement concerns in the United States. Patents are owned by the association and the members are allowed to use the patented devices, and it is announced that properly equipped plants will be admitted to membership. At the same time the association purposes to prosecute non-members who are without the licenses. It is said that 70 per cent of the output of Portland cement in the United States is represented in the industry. The North American Portland Cement Company is the corporation thus formed by the Association of Licensed Cement Manufacturers, and it controls the Hurry & Seaman and Carpenter patents covering the burning of cement with pulverized coal in rotary kilns and the Edison long kiln patents. The North American Portland Cement Company was organized in the latter part of 1906, with a capital stock of $10,000,000, having among its purposes the taking over from the Atlas Company of the Hurry & Seaman and other patents and the licensing thereunder of Portland cement manufacturers. During the past year the North American Company has been extremely active in acquiring other patents for the protection of its licensees. Another marked advance in the cement industry was due to Mr. Thomas A. Edison, who devised new burning kilns, together with several unique methods of fuel consumption. In particular, he designed and had patented a rotary kiln 150 ft. long, and 7 to 8 ft. in diameter, having a daily capacity of from 700 to 1,000 barrels of cement. Until that time the largest kilns in use were 60 to 80 ft. long, 5 and 6 ft. in diameter, with a capacity of but 200 barrels a day. Edison's long kiln was universally ridiculed by the older manufacturers. But its success soon proved their criticism to be unwarranted. The adoption of the long kiln by the Portland cement industry in general, and the consequent possible infringement of the exclusive patents held by Edison covering it, proved to be a fertile source of litigation, which was only recently terminated by the acquisition by the North American Company of the patents for long kilns, burners and similar apparatus owned by Mr. Edison.

POWER PLANT STEAM TURBINES.—The extent to which steam turbines are now specified as prime movers for central power houses, municipal lighting stations and electrified industrial plants may be seen in the fact that Allis-Chalmers Company has at present on the erecting floor of its West Allis works units as follows: A 2000 kilowatt set for the Delaware, Lackawanna & Western Railroad, to be installed in its collieries at Scranton, Pa.; 1500-kw machines for the city of Jacksonville, Fla.; Youngstown (Ohio) Sheet & Tube Company; Tremont & Suffolk Mills, of Lowell, Mass.; Cedar Rapids & Iowa City Railway Company, of Cedar Rapids, Ia.; American Thread Company, for its Watuppa Mills, and the Scranton, Pa., Gas & Electric Company; 1000-kw units for the Nairn Linoleum Company, Kearny, N. J., and the Celluloid Company, of Newark, N. J.; turbines of 750 kilowatts each, for the Lawton Spinning Company, Woonsocket, R. I., and the Pacific Mills, of Lawrence, Mass., and 500-kw machines purchased by the Everett Pulp & Paper Company, of Everett, Wash.; Savannah Lighting Company, Savannah, Ga., and the Celluloid Company. Six of these are on repeat orders from as many different users, some of which have already more than one Allis-Chalmers turbine installed, and all include generators especially designed for operation with them.

THE STANDARD ELECTRIC & ELEVATOR COMPANY, 211 South Charles Street, Baltimore, has taken over the electric and elevator departments of the Crook-Horner Company, which latter will hereafter devote itself exclusively to the supply business. The mechanics and electricians employed by the Crook-Horner Company on elevator work have also been taken over. Messrs. R. P. Thomas and Guy K. Mitchell, formerly the managers of the above departments of the Crook-Horner Company, are respectively manager of the elevator department and manager of the electrical department of the Standard Company.

BALL BEARING PLANT.—The Hess-Bright Manufacturing Company, Nineteenth and Hamilton Streets, Philadelphia, informs us that it has been found necessary to make the third change to larger quarters and that it will shortly occupy a four-story building, with a floor space of 15,000 sq. ft., exclusive of the basement, which is given up to a modern construction gas producer power plant. Aside from the ball bearing division this is the largest plant devoted exclusively to the manufacture of ball bearings of only one grade, that of the annular type. The new quarters will be occupied sometime within the next six weeks.

WESTINGHOUSE ORDERS for the month of January show an encouraging increase over December, and there is a large amount of new business in sight for electrical apparatus. Electric railways, central stations and power transmission enterprises are resuming work and extensions dropped when the financial troubles broke over the country last October.

APPARATUS FOR RIO DE JANEIRO.—Among other foreign shipments of the Westinghouse company are six 5,000-kw generators to the Rio Janeiro Tramway, Light & Power Company, Brazil. The plant is situated outside of the city of Rio Janeiro, with a main station in the city. A line pressure of 80,000 volts is employed.

EXPORTS TO GERMANY.—The Bureau of Statistics of the Department of Commerce and Labor notes the July-December, 1906, exports of electrical appliances to Germany as $181,336, as compared with $145,758 in 1907; and the exports of electrical machinery as $49,530, as compared with $42,126.

AUTOMATIC TELEPHONY.—The Eastern Trading Company, as agents for the Automatic Telephone Construction Company, have installed an experimental exchange, with 15 phones, in Shanghai. Efforts are being made to introduce the system in other large Chinese cities.

ELECTRICAL OUTLOOK IN WESTERN SOUTH AMERICA.—Discussing electrical conditions in Chile and the other states on the western coast of South America, Mr. Walter T. Peck, an American engineer who has recently returned from that section, sees excellent prospects for electrical development in that part of the globe during the next decade. "In Chile, where the large electrical enterprises are nearly all financed by German capital," said Mr. Peck, in an interview with a representative of the ELECTRICAL WORLD, "naturally, German engineers and German machinery remain in the ascendency, but English and American engineers are pushing hard on the Germans. During the last five years especially, the demand for American machinery has picked up in a remarkable manner. In Peru, the Americans had a better start than in Chile and dominate the situation. Lima, the largest city, has excellent water-power, which supplies current for the three tramway systems in the city besides current for lighting and other purposes. Among other new projects under consideration in Chile is the transformation of a large steam power plant at Santiago into a 20,000-hp hydraulic electrical plant, which will supply light and power to the city of Santiago and the surrounding districts. German capital will finance the project and German machinery will be used in the installation of the plant. One of the latest installations by Americans which is now under way is an interurban line from Talcahuano to Concepcion, the plans of which include local lines in both places. The road between the two places will be nine miles long and the electrical plant will have a capacity of about 1500 hp. Both passengers and freight will be transported when the line is completed. In passing, it might be well to note that Talcahuano is second in commercial importance only to Valparaiso. A Chilean company is financing the project, but the machinery is entirely American. The roads will be ready for operation within a few months. A somewhat smaller road which was opened last month and which is equipped with American electrical machinery, is the line from Santiago to San Bernardo. This road is also about nine miles in length and the electrical plant is operated by hydraulic power, with English suction gas producers as reserves. The work was done by native engineers and was backed by native capital. A combination of Chilean capitalists, which controls a large number of local electric lighting plants throughout the state, has in hand plans to install five other plants in the near future at various places. The combination which was entered into about four years ago controls at present the electrical plants at San Bernardo, Rancagua, San Fernando, Curico, Lo Bravo, Talca, Chillan, Los Angeles and Temuco. Unfavorable financial conditions have halted operations for a while, but the situation has improved so much of late that the work will be pushed forward in the near future. The new stations will all be operated by hydraulic power with no steam, oil or gas engines as reserves. The regions of the nitrate fields in the northern part of Chile seem to offer the best prospects for electrical development in the immediate future. There, as in other places, the high price of coal is a serious obstacle and the low pressure steam engine plants now in use are being rapidly replaced by electrical equipments with steam, oil or gas engines as reserves."

GROWING INDUSTRIAL ACTIVITY.—From various quarters come the reports and evidences of returning industrial activity. Plants in the Pittsburg district, which have been closed down or running on short time, are rapidly resuming operations in full. The Clark mills, of the Carnegie Steel Company, have started to work full time, with both day and night shifts, giving employment to 900 additional men. The seventy-two-inch mill of the Carnegie Steel Company, at Homestead, resumed last week in full, with day and night shifts. The Cannonsburg Steel & Iron Company, which has been idle for two months, has started full, as did the Standard Tin Plate Company, and the East Palestine Pottery Company, both of which have been idle for some time. At Detroit the American Car & Foundry Company put 5,000 men on full time, and the Cadillac Motor Car Company did the same for 2000 men. The Thomas Auto Company will resume on full time this week, and the Ford and Packard auto companies already are busy. The big paint companies, the Acme and the Detroit White Lead, are running on nearly full time with a full force. Berry Brothers' Varnish Company, Parke, Davis & Co. and the Frederick Stearns medicine manufacturing companies, employing thousands of men, are running full time. The Russell Wheel & Foundry Company has booked enough orders to last the winter out, and will resume operations in full next week. Reports of an optimistic nature come from Saginaw, Marshall, Charlotte, Holland, Pontiac and other places.

PLANT FOR IOWA.—It is stated that plans have been prepared for additions to the plant of the Spencer, Iowa, Municipal Light & Water Works. The city is in the market for one alternator of 120 kw, 60-cycle, three-phase, revolving field, 2300 volts, belt driven, about 550 r. p. m. with exciter and rheostat, and one alternator about 50 kw of the same type, of 2300 volts, belt driven to about 800 r. p. m., with exciter and rheostats. Bids will also be received on the same equipment with direct connection, engine running at about 250 r. p. m., for the belt driven equipment. A Corliss engine of about 70 hp will be considered, and for direct connection a high-speed engine of the same capacity. There will also be required one 150-hp open feed water heater, two boiler feed pumps, one with capacity of 1250 gals. and the other 3100 gals. per hour, the two pumps being preferably coupled, so that both can be driven together either by gear, belt or direct connection to motor or single cylinder steam engine. The purchasing committee has also under consideration the installation of a gas producer equipment of from 80 to 100 hp. The plant is managed by Mr. R. L. Taylor, and Mr. R. T. Turner is superintendent.

MOTORS FOR NECAXA.—Shipments of motors by the Westinghouse company are being made to the Necaxa station of the Mexican Light & Power Company, of Mexico City. The Mexican government is installing an extensive system of water works, which when finished will be among the finest in the world, but as yet the work is far from being completed. Water will be conducted to the city from springs 100 miles away through an 8-ft. conduit and will be pumped by electricity into a high-pressure reservoir. As the springs are but little above the city level, the water will be forced through the conduit by pumps driven by motors in four stations. The fifth pumping station forces the water into the reservoir. The electrical equipment of station No. 1 consists of two 1400-kva 3000-volt synchronous motors and nine 475-kw transformers. Station No. 2 will be equipped with two 40-hp 200-volt motors. In station No. 3 there will be two 120-hp motors, No. 4 will contain two 125-hp motors, and No. 5 two 260-hp motors.

ZINC REDUCTION.—U. S. Consul L. Edwin Dudley, of Vancouver, sends the following note in regard to a new zinc reduction enterprise in British Columbia: "The Canada Zinc Company is making good progress with the completion of its plant, which should be finished and in operation by the beginning of next February. The plant is designed for electric reduction of zinc, the first of its kind on the continent, although a similar plant is working successfully in Sweden. At the present time much of the lead ore of the Slocan occurs with zinc, and a penalty is demanded by the smelters for zinc units when over 10 per cent. This frequently means that the lead mine cannot be operated because of the zinc penalty and because no values are obtainable for the zinc. The establishment of the Canada Zinc Works in Nelson means the opening up of many idle Slocan properties."

A POWER PLANT DISPUTE.—At St. Cloud, Minn., an action has been brought against the Soo Railway Company by the Pike Rapids Power Company to recover $800,000 damages. According to the claims the Pike Rapids Company owns a certain site for a dam on the Pike Rapids near Royalton, and has purchased and owns all the needed flowage rights, together with 35 acres of land on both sides of the river. It is alleged that the Soo Railway Company without the consent of the Pike Rapids Company has appropriated the said site and has constructed thereon a bridge to span the Mississippi. In addition the railway company is claimed to have trespassed on the land, and the power company claims that its property has become useless because of the construction of the bridge. It asks damages for the full amount of the loss.

THE IMPERIAL ELECTRIC COMPANY, of Akron, Ohio, has been organized with a capital stock of $180,000. It is reported that the new company will reorganize the Akron Electrical Company, as the first step taken by the promoters of the new corporation was to prepare for the purchase of the plant and equipment of that company. The plant, it is said, will be kept in operation steadily and as soon as possible the output will be increased. As is well known, motors and other electrical machinery are manufactured by the Akron Company. The incorporators of the new company are E. E. Andrews, R. E. Inskeep, William Weaver, W. C. Hall and A. C. Linzee.

THE WEEK IN COPPER.—A sharp advance in the price of copper metal, followed later by an equal drop, marked the week in the copper market. On Jan. 29 the United Metals Selling Company raised the price from 14⅛ to 14¼ cents a pound for electrolytic copper. This was the first time in months that a definite figure had been named by the trust, and it was thought that the advance indicated that the trust had once more taken the market in hand with a view to fixing the price for further advances later. The improvement of business conditions in the United States and the large foreign demand for copper seemed to justify the action of the trust in raising the price of metal. During the last four months Europe has been a heavy purchaser of copper. Following are the export figures:

September	17,157	tons
October	29,161	"
November	34,087	"
December	37,685	"
January (estimated)	28,869	"

Total for 1906, 205,460 tons.
Total for 1907, 228,708 tons.

The heavy foreign buying is for speculative purposes, and one for years in close touch with the copper situation expressed an opinion that the exportation might mean a sudden drop in price in the United States in the near future. "Whether we used foreign shipments of copper as the easiest way to raise money or whether the move is a purely speculative one on the part of the buyers, is a question whose answer we will learn shortly," he said. "If Europe was using copper at the rate the shipments indicate, the price of metal would go up in all markets. But the English jobbers are loaded up with hundreds of thousands of pounds of copper, which were bought in this country at prices considerably lower than we could purchase the metal, and it is more than likely that some one over there will get tired of carrying a heavy stock waiting for a copper market, and will liquidate at a sacrifice. Then the London market will drop and our market also, through sympathy." The advance in price by the trust was followed by a cut on the part of the independents, who dropped ⅛ off, making the price for electrolytic 13⅛, and it looked much like the situation last fall when the United Metals Selling Company "held the bag" for the independents, doggedly maintaining prices despite frequent cuts of the others. A further cut of ⅛ by the independents, however, swung the trust into line, and the market closed on Monday with prices as follows:

	Bid.	Asked.
Lake	13.50	13.75
Electrolytic	13.37½	13.62½
Castings	13.12½	13.37½

"I do not expect to see any marked change in the copper market for several months," said the purchasing agent for an electrical concern, which is among the great copper consumers in the country. "Prices should hold comparatively steady because there is nothing to start them in either direction. Raising the price of metal certainly would not encourage buyers, and I do not believe that if copper was offered in great quantities at 9 cents a pound, there would be any more buying than there is at present. The facts of the case are, that none of us have any ready money to tie up in large stocks." Inquiries among copper consumers show that there is no more buying at present than there was a week ago. Dealers are living from hand to mouth, "buying just enough metal to keep our heads above water," as one said. Houses which a year ago bought copper by the carload are now purchasing in 25,000 pound lots.

CANVASS OF BUSINESS CONDITIONS.—Replies from all over the United States to the head of one of the largest electrical supplies manufacturing houses in the country, who wrote to all his agents requesting them to give an expression of the business outlook in their immediate territory, show a healthy spirit of optimism among the electrical houses. Following is a brief summary of several of the letters received. They are selected with a view to giving the expression of feeling in the business world in diverse parts of the country.

Missouri.—A considerable increase in business is looked for within the next two months. The factories are resuming operations either fully or in part. Business is not what it should be, but is much improved as compared with the period immediately before the holidays. Business in the city of St. Louis shows a substantial increase in the last few weeks, and there is a marked improvement in the country sections.

Ohio.—The contractors are quite busy, but building operations have been impeded considerably by the financial conditions. Cincinnati and the vicinity seem to have suffered far less in the recent commercial crisis than many other sections.

Pittsburg.—The Electrical Union which went on a strike on Dec. 26 has not yet voted to return to work. Consequently electrical construction operations are practically at a standstill. In other respects the outlook is excellent.

Seattle, Wash.—Nearly all building has stopped, but the business men are confident in their assertions that the present depression is but temporary, and say that by spring Seattle and the vicinity will go ahead with the same energy as in the past.

Georgia.—The outlook is much more encouraging than at any time during the last two months. New construction work is being pushed ahead, and the general business tone is very optimistic.

Denver, Col.—Construction work has been hampered by the lack of ready money. If some way can be devised to relieve the currency stringency business should be in fine shape by summer.

PLANT FOR OSAKA, JAPAN.—First shipments for the new light and power plant at Osaka, Japan, are being made by Takata & Company. When the plant is completed, it will be the largest light and power station east of the Suez Canal. Osaka lies on the southern coast of the island of Nippon, about 350 miles from Tokio. With a population of more than a million, it ranks among the 16 largest cities in the world. Formerly the city was lighted largely by gas and by a few small power companies which have been merged into the new corporation which has been formed. The equipment for the new light and power plant consists of five 3000-kw Westinghouse steam-turbine outfits, 11,000 volts, 3-phase, 60-cycle, 1200-r. p. m. Each set is provided with a 37½-kw exciter, connected directly. The auxiliary machinery consists of two motor-generator exciter sets, 230 hp directly connected to a 150-kw exciter, 125 volts; also nine 100-kw single-phase 11,000-volt transformers and six 75-kw, single-phase, 11,000-volt transformers. There are four motor-generator sets for the sub-stations each of 15-hp. The motors are directly connected to 7½-kw, 125-volt generator. There have also been supplied a large main station switchboard and a secondary switchboard for each of the four sub-stations.

3000-HP. 20,000-VOLT PORTO RICO PLANT.—Work on the electric plant near the town of Comerio, Porto Rico, which was begun last spring by J. G. White & Company, is nearing completion. The plant is being built near the Comerio Falls which, with a head of 180 ft., will supply the necessary power. Its capacity will be 3000 wheel hp. The water-wheels are turbines of the Francis inflow type, built by the I. P. Morris Company. There are four in all, two on each penstock. The plant will supply power service and light for the city of San Juan and the immediate vicinity. It will also furnish current to operate the electric roads in San Juan, and the extension line to Caguas. San Juan is about thirty miles from Comerio, and the 20,000-volt current will be conducted by double transmission lines. The generators in the power-house are of the General Electric type. The work has been advanced by the Porto Rico Railroads Company, Ltd., and is financed by a group of Canadian capitalists.

PACIFIC COAST POWER.—Advices from Tacoma, Wash., state that, with a capital of $10,000,000, the Pacific Coast Power Company will develop 100,000 e. h. p. at Lake Tapps, 11 miles from Tacoma. The company has just been organized by Stone & Webster, of Boston. The present interurban will be extended north to British Columbia and south to Olympia, Gray's Harbor and perhaps Portland. The Lake Tapps power will be used in operating the gauge railway and for lighting and commercial purposes. Beginning at once, 50,000 hp will be developed, and the remainder within three years. The company has purchased all conflicting rights along White River and Lake Tapps. The White River will be carried by canals and flumes into Lake Tapps, situated on the shoulder of a mountain. Through steel pipes water will be dropped 500 ft. over the mountain side, driving Pelton wheels in the power houses below.

BUSINESS OPTIMISM.—J. B. Olson, of the Habirshaw Company, is inclined to take an optimistic view of financial and business conditions throughout the country. "It is the logical time for optimism," he said. "To be sure things are quiet now, but if prophets be prophets, and if we can place any reliance in indications and signs, we may believe in a speedy restoration of normal conditions. The bottom has been reached, the climax passed, and now we are on the rising grade. The upward tendency of the market, the encouraging bank statements, and the general tone of the business world, all point but one way, and that is upward."

GENERAL ELECTRIC PLANTS IN JAPAN.—The General Electric Company furnished to the Ugi River hydro-electric installation in Japan 18 water-cooled and 54 oil-cooled transformers, 81 single-phase induction feeder regulators, 149 switchboard panels, and a large quantity of lead-covered cable. It is furnishing the complete electrical equipment for a hydro-electric plant at Nagoya, Japan. There will be four three-phase 2500-kw generators, 12 water-cooled 1000-kw 60,000-volt transformers, and 9 water-cooled 60,000 to 11,000 volt 1350-kw transformers, and 9 11,000 to 3400 volt 1350-kw transformers. The transmission line will be 30 miles in length.

KELLOGG-AMERICAN BELL DEAL DECLARED ILLEGAL.—Judge Windes, on Feb. 1, rendered an opinion in the suit of Mr. Milo G. Kellogg, declaring it against public policy for one corporation to hold stock in another, and ordered that the controlling interest in the Kellogg Switchboard & Supply Company acquired by the American Telephone & Telegraph Company, amounting to 4400 shares, be sold back to the original owners, the price to be the same as that paid, with interest at 5 per cent. Meanwhile the court will exercise authority over the affairs of the Kellogg Company.

HUDSON COMPANY BONDS.—The banking firm of Harvey Fisk & Sons will immediately offer for sale an issue of 6 per cent notes of the Hudson Company, the sale of which will provide funds necessary to complete the building operations and equipment of the Hudson & Manhattan Railroad Company's system. The exact amount of issue has not yet been settled upon.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was quiet and irregular, bullish speculation having been restricted by the bank suspensions at New York and the government proceedings against the Union Pacific-Southern Pacific merger. At the close of the week there was a sharp break in prices. The market was little influenced by the fact that money continues to accumulate in the banks, and the lower interest rates. A leading feature throughout the week was the activity and strength of the bond list, and a very large and widespread investment demand was in evidence. The report of the United States Steel Corporation for the December quarter was not unfavorably received and, in fact, did not seem to create any particular bearishness on the Steel stocks. The continued appearance of heavy decreases in the earnings of railroad companies, and the reports from all parts of the country of slack traffic, also received attention. The local traction securities were also made prominent by a bullish movement in them, Interborough-Metropolitan being affected by vague talk of coming steps to reorganize that combination, while Brooklyn Rapid Transit was influenced by intimations of the probable resumption of dividend payments. The electric securities were quiet and weak, and prices generally receded. The curb market showed irregular price movements during the week, with early steadiness succeeded by general recessions. United Copper common sold down around 6, a new level. Following are the closing quotations of Feb. 3:

NEW YORK.

	Jan. 27	Feb. 3		Jan. 27	Feb. 3
Allis-Chalmers Co.....	6	6	Interborough Met. com.	5	7¾
Allis-Chalmers Co. pfd.	19	18	Interborough Met. pfd..	16	20⅝
Amalgamated Copper....	—	50⅜	Mackay Cos.	55	54
Am. Dist. Tel.....	30*	—	Mackay Cos. pfd.....	60	61
American Locomotive...	36⅝	37	Metropolitan St. Ry....	20	—
Amer. Locomotive pfd..	90	90	N. Y. & N. J. Tel.....	101	100
American Tel. & Cable..	55	—	United States Steel com.	28¼	28
American Tel. & Tel...	107	106	United States Steel pfd.	92	92½
Brooklyn Rapid Transit.	45⅛	45½	Western Union Tel....	57½	54½
General Electric	119	119	Westinghouse com.....	42	41½
Hudson River Tel.....	—	—	Westinghouse pfd.....	75	—

BOSTON.

	Jan. 27	Feb. 3		Jan. 27	Feb. 3
American Tel. & Tel...	108¼	106¾	Mass. Elec. Ry. pfd....	48	47½
Cumberland Telephone..	—	108	Mexican Telephone.....	5½	1½
Edison Elec. Illum.....	210	209	New England Telep....	109	—
General Electric	121	—	Western Tel. & Tel.....	—	6½
Mass. Elec. Ry.....	11¼	11	West. Tel. & Tel. pfd..	—	62½

PHILADELPHIA.

	Jan. 27	Feb. 3		Jan. 27	Feb. 3
American Railways.....	43	43	Phila. Electric	6⅛	6
Elec. Co. of America...	8⅜	9	Phila. Rapid Transit....	16	16
Elec. Storage Battery...	29	28	Phila. Traction	88½	89
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	Jan. 27	Feb. 3		Jan. 27	Feb. 3
Chicago City Ry.....	166	165	Metropolitan Elec. com.	18	18
Commonwealth-Edison ..	—	87	National Carbon.....	55	55*
Chicago Subway	—	—	National Carbon pfd...	—	101
Chicago Tel. Co.....	—	115			

*Asked.

DIVIDENDS.—Directors of the J. G. Brill Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Feb. 1. They also declared a regular quarterly dividend of 1 per cent on the common, payable March 14. National Carbon Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Feb. 15. The quarterly dividend of 1¼ per cent on the American Telegraph & Cable Company is payable March 1. Directors of the American Graphophone Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Feb. 15. The Washington Water Power Company has paid its regular quarterly dividend of 1¾ per cent on the capital stock. The directors of the Susquehanna Railway, Light & Power Company have declared a regular semi-annual dividend of 2½ per cent on the preferred stock, payable March 1. Directors of the Ohio Traction Company have declared a regular quarterly dividend of 1¼ per cent on the preferred stock, payable Feb. 1. Directors of the Chicago City Railway have declared an extra dividend of 2¼ per cent, payable Feb. 10. Directors of the Consolidated Gas Company have declared the regular quarterly dividend of 1 per cent, payable March 16.

STOCK ISSUE OF THE COLUMBUS (O.) EDISON LIGHT & POWER COMPANY.—A statement accompanying a notice for a special meeting of the stockholders of the Columbus Edison Light & Power Company states that a proposed increase of capital stock to be voted upon will be used to liquidate a debt to the Columbus Railway & Light Company, incurred through its making improvements, betterments and extensions to the plants and the systems. The aggregate of these expenditures is $466,289.44. Of the $100,000 preferred stock in the treasury, $61,300 received in cash from the sale and the remainder of the stock, $38,700, has been turned over to the Columbus Railway & Light Company. A price of 110 has been placed upon the unsold stock. The directors of the Edison Company will recommend the authorization of sufficient stock not only to take care of this debt, but to cover betterments and extensions that will be required in the future. A statement of the operation of the plants since they were taken over by the Columbus Railway & Light Company on June 30, 1903, also accompanies this notice.

MORE TELEGRAPHONE STOCK.—A circular is being sent out from a Wall Street office offering telegraphone stock at what is stated to be a reduced figure, coupled with the promise that money will be loaned to purchasers with the stock as collateral. Some months ago, as reported in these columns, the firm which formerly exploited the stock stated at the conclusion of a controversy with an agricultural journal, which had advised its readers against the purchase of the stock, that the entire issue of $5,000,000 had been disposed of and therefore it had no further interest in continuing the correspondence. Whether the stock now offered is a new issue or some of the former stock cannot be determined from the circular.

BELL TELEPHONE.—In a recent interview, President Vail, of the American Telephone & Telegraph Company, said that the coming annual report is such a good one that the company could easily pay 10 per cent on the stock if the directors desired it. He states further that the company will not need any new money for over a year at least, the appropriation for extensions and improvements for the current year already having been provided for. About $40,000,000 will be spent for betterments in this year, as compared with about $25,000,000 for the past 12 months.

INCREASE OF TELEPHONE CAPITAL.—The stockholders of the Southern New England Telephone Company have authorized the directors to issue at their discretion $2,000,000 in capital stock. This with $300,000 of new stock that has already been authorized by the stockholders but not yet issued will bring the capital stock of the company up to $10,000,000, the limit under the present authority of the Legislature.

MACKAY-BELL.—The report is denied that the Mackay Companies have disposed of part of their holdings of American Telephone & Telegraph stocks. On the contrary, they have added between 15,000 and 20,000 shares, it is said, during the past six months, making a total ownership of over 100,000 shares.

CONSOLIDATED GAS.—In the annual report just adopted, Mr. W. R. Addicks, the acting president, stated that the City of New York on Jan. 1 owed the company no less than $6,184,341 for gas and electricity supply, not including interest.

NORTH AMERICAN REPORT.—The annual report of the North American Company shows receipts of $7,962,185 and disbursements of $6,128,241, of which $5,392,346 was in dividends. On Dec. 31 there remained undivided profits of $1,996,613. During the year the company has sold to the Milwaukee Light, Heat & Traction Company the entire common capital stock of the Milwaukee Electric Railway & Light Company ($9,000,000 par value), and has received in payment therefor the capital stock and refunding and extension mortgage bonds of the Traction Company, the sale or exchange having been made in the belief that the future development of these properties can be more effectively provided for through the instrumentality of the Traction Company as the controlling company. In revaluing the assets of the company as of Dec. 31, 1907, the sum of $2,290,365 has been written off from its undivided profits. To the making of this revaluation, the board of directors have given their most careful consideration and the valuations assigned are believed to be conservative. During the year the Union Electric Light & Power Company has purchased all the assets, property and franchises of the Laclede Power Company, of St. Louis (including the Edison Electric Illuminating Company, of Carondelet, owned by the Laclede Power Company), which company owned a central electric generating station situated on the riverside adjoining the main station of the Union Company, having a rated capacity of 7000 kw, an extensive distributing system and an established business of about $500,000 a year. By the acquisition of this property, the Union Company will be enabled to avoid wasteful duplication of investment, especially in the development of its sub-station and distribution systems, and to reduce certain expenses of operation incident to competition. The increased efficiency of the combined system and the resulting economies in capital investment and operating expenses must tend to the advantage of the public, as well as of the company. The North American report comments favorably on the laws for supervision and regulation passed in the states where its various subsidiary properties are located.

TELEPHONY IN MEXICO.—Active competition has developed between American and Swedish capitalists in the telephone business in Mexico. The Mexican Telephone & Telegraph Company, a Bell concern, with headquarters at Boston, has been operating in the larger cities for several years under the Bell system, but did not hold an exclusive concession, and when the Ericsson Telephone Company, of Stockholm, Sweden, made application to install a local competing system in Mexico City, the Government granted it. The Ericssons are said to have invested over $2,000,000 in underground conduits and telephones, and now have in operation over 500 telephones. The exchange is equipped to accommodate 15,000 subscribers. The company is also extending to all the suburban towns in the federal district, and has installed exchanges at Tacu-Baya, Xochemilco, Guadalupe and Contreras. It has a long-distance line in operation between Toluca and Mexico City, about 50 miles, and has planned to cover the whole of Southern and Central Mexico. It holds concessions from the state governments of Vera Cruz and Pueblo, and work will be undertaken when plans in Mexico City are further advanced. The Mexican Telephone & Telegraph Company is also very active in expansion. It has two large exchanges in the central part of the city, local exchanges at Guadalupe, Popla, Tacu-Baya, Coyoacan and Tlalpam, all suburban towns, and will soon have a long-distance line between Mexico City and Pachuca. Mr. John Woessner, formerly American consular agent at Saltillo, is establishing a long-distance system in Northern Mexico, with Torreon as headquarters. It embraces Monterey, Saltillo, Torreon, Durango and a number of smaller towns.

BELLEVUE (O.) ELECTRIC LIGHT LITIGATION.—A. H. Smith has filed suit against the Bellevue Light & Power Company, the Bellevue Illuminating Company, John W. Moore and F. B. Carr, asking for a receiver to take charge of the Bellevue lighting plant and handle the income and profits. He alleges mismanagement on the part of the officers and directors. The petition states that the corporation was first organized as the Bellevue Light & Power Company, but that in 1903 John W. Moore secured control and managed it. It is alleged that large sums of money were spent in obtaining a second franchise. Further, the allegation is made that Moore was indebted to F. B. Carr and that the capital stock of the corporation was transferred to him. Carr then took charge of the business and, it is alleged, organized the Bellevue Illuminating Company, which move will result, he says, in defrauding the original bondholders. The petition asks that Carr be enjoined from disposing of the property. The suit is said to have been brought in the interests of all the bondholders.

WESTINGHOUSE LAMP COMPANY.—It is learned that the Westinghouse Lamp Company, manufacturers of incandescent electric lamps, and one of the constituent companies of the Westinghouse Electric & Manufacturing Company, have obtained the signatures of 99 per cent in amount of the creditors to the readjustment plan permitting a discharge of the receivership. The receivers have found the company's financial condition to be entirely sound, the assets being approximately five times as great as the liabilities. The formalities connected with the application to the court for a discharge of the receivers are now under way, and it is expected that the company will be returned to its shareholders by the first of March. The business of the company has continued without interruption during the receivership. The officials of the company are expecting to have the new plant at Bloomfield, N. J., in operation before the end of the summer. It will have a capacity of over 15,000,000 lamps per year.

PHILADELPHIA ELECTRIC.—The Philadelphia Electric Company has issued this announcement regarding the stock dividend and the cash assessment ordered by the directors: "Directors of the Philadelphia Electric Company have declared a stock dividend of $1 per share from the surplus of the company, payable March 2 to stock of record Feb. 20. The dividend will amount to $1,000,000, or 10 per cent of the paid-in capital of the company. The board also called an assessment of $3.50 per share, payable in installments of $2.25 and $1.25, on March 2 and June 1, respectively. The dividend declared may be applied upon the payment of the first installment of the assessment, so that stockholders will have to pay but $1.25 per share in cash on March 2. This is the first call made upon the stockholders for additional capital since April, 1904. Since that time large sums of money have been expended upon permanent improvements and extensions of the company's properties. The gross earnings for the year ended Dec. 31, 1907, are estimated at $4,950,000, against $4,503,878 in 1906 and $4,104,113 in 1905."

TELEPHONY IN NEW YORK STATE.—Active steps are being taken to unite all the operating independent telephone companies from the Hudson River to Buffalo, including a score or more under the United States Independent Telephone Company system. A committee of the company now has the matter in hand. The plan is the result of a meeting of United States telephone men and a committee representing the Consolidated Telephone Company, of Buffalo. It is understood that approval of the plan would obviate the necessity for the foreclosure sale of the United States company planned for Feb. 4. The proposition involves telephone properties in Rochester, Buffalo, Syracuse, Rome, Schenectady, Albany and possibly Utica.

WESTERN UNION STOCK.—It is stated that it has already been decided to pay the next quarterly Western Union Telegraph dividend of 1¼ per cent in stock, repeating the action taken in December. Western Union has outstanding, including the 1¼ per cent dividend recently paid in stock, a total of $98,587,025 stock, leaving a balance of $1,412,975 in the treasury, or only $195,950 more than would be required to pay the next dividend in stock. The reduction of the dividend rate might in reality help the stock, which is very cheap on the present basis.

MASSACHUSETTS ELECTRIC EARNINGS.—The statement of Massachusetts Electric for the quarter to Dec. 31, 1907, the first of the fiscal year, does not compare favorably with the figures of a year ago. Gross earnings were $1,780,074, an increase of $55,455; net was $459,411, a decrease of $26,401, and the balance for dividends was $22,975, a decrease of $52,545. Operating expenses showed a large increase. The showing for the current quarter, the least favorable of the fiscal year, promises to be better than usual, unless conditions change greatly.

CHICAGO TRACTION FUNDS.—With regard to the new funds required by the Chicago Railways Company, which is the rehabilitation of the various traction lines of that city, it was announced last week that N. W. Harris & Co. and the National City Bank have completed arrangements covering $12,000,000, as well as any "additional funds which may be necessary for the further improvement, betterment, extension and equipment of the property."

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

CALERA, ALA.—The local electric light plant owned by P. J. Jeminez has been purchased by F. Stein, who will improve the service.

SOLOMONSVILLE, ARIZ.—C. B. Jameson, of Kentucky, will install a power plant at either Safford or Thatcher and erect transmission lines to Solomonsville and Pima. He is at present negotiating with the towns of Safford, Thatcher and Pima for franchises to use the streets of those towns.

ARGENTA, ARK.—The overhead work on the lines of the Argenta Street Railway Company has been awarded to the Electric Construction Company, of Little Rock.

EUREKA SPRINGS, ARK.—The Interstate Hydro-Electric Light & Power Company, which is developing water power on the White River, is planning further developments, increasing the output of the plant to 5000 horse-power. The company proposes to furnish electricity for manufacturing, mining and other industrial purposes. W. D. Chesney, Rosedale Station, Kansas City, Kan., is secretary.

JUDSONIA, ARK.—A telephone company has been organized in this city with W. L. Gossett as president.

NEWPORT, ARK.—The City Council is prepared to receive bids for an electric light franchise.

ROGERS, ARK.—A movement has been started in this city for the establishment of a municipal electric light plant.

HANFORD, CAL.—The Board of Supervisors has granted a franchise to F. S. Granger to construct an electric railway.

OAKLAND, CAL.—E. H. Downer, of Pinole, representing the Great Western Power Company, has been granted a franchise by the Board of Supervisors of Alameda County to erect and maintain electric transmission lines over the county roads and highways. The company recently purchased an entire block of land in East Oakland, on which it will erect an auxiliary plant of from 20,000 to 30,000 horse-power. A site also has been purchased for a large sub-station in East Oakland.

OAKLAND, CAL.—The Home Telephone Company, of Alameda County, has applied to the Board of Supervisors for a franchise to extend its telephone system, which is operating in Oakland, throughout the county.

QUINCY, CAL.—The Quincy Electric Light Company is preparing to install a new plant.

SAN JOSE, CAL.—The City Council has awarded the contract for lighting the streets of the city to the United Gas & Electric Company for a term of five years. The company agrees to furnish energy for arc lamps with all-night service, moonlight schedule, for $3.50 per lamp per month; every night with all-night service for $6.30 each per month. The company also agrees to furnish electricity for commercial lamps at the rate of $2.50 per month per lamp until 1 a. m., moonlight schedule.

SAN BERNARDINO, CAL.—A. E. Poole is interested in a project for the development of water power in the San Bernardino forest for electrical purposes. The government has granted Mr. Poole a right of way two and one-half miles in length, and the plants will be erected within the watershed of the San Jacinto Mountains. One of the power plants will be erected at Palm Springs on the desert in Riverside County.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has decided to increase its capital stock from $500,000 to $5,000,000, the proceeds to be used to make important additions to its system.

HARTFORD, CONN.—The Railroad Commissioners have granted the petition of the New York, New Haven & Hartford Railroad Company for authority to take under condemnation proceedings land needed for the right of way for an electric road in the town of Middlebury. The property is needed in connection with an electric railway the company proposes to build from Waterbury to Middlebury, thence to Woodbury.

NEW BRITAIN, CONN.—The Connecticut Company has submitted a proposition to the Board of Public Works offering to furnish electric incandescent lamps in place of the Welsbach lamps now in use. The company offers to furnish 182 or more 25-cp incandescent lamps, in addition to the present lamps, at $20 per lamp per year for all-night service.

WASHINGTON, D. C.—Bids will be received until Feb. 15 by Elliott Woods, superintendent U. S. Capitol buildings and grounds, for electric conduit, etc., required in connection with the electrical equipment of the Senate office building.

WASHINGTON, D. C.—The contract for furnishing and installing the electric wiring for the new building for the National Museum has been awarded to the Lord Electric Company, of New York, N. Y., for $74,777. Bernard Green is superintendent of construction of the National Museum.

WASHINGTON, D. C.—The contract for the electrically driven pumps in connection with the irrigating work, known as the Garden City Project, at Deerfield, Kan., has been awarded by the Department of the Interior, U. S. Reclamation Service, to the Buffalo Forge Company, Buffalo, N. Y.

ST. PETERSBURG, FLA.—The telephone systems of Clearwater and Tarpon Springs have been purchased by A. P. Avery, Joseph Patton and H. B. Webster, which they will consolidate with the St. Petersburg system. Improvements and new lines are contemplated.

AUGUSTA, GA.—Bids will be received until Feb. 25 by the commanding officer of the Augusta arsenal for furnishing and delivering electric switchboard, motor generator sets, air compressor, metal working and wood working machines, some with motor drive, pneumatic hammer, electric and overhead cranes, fuel oil furnaces, testing machine, etc.

SAVANNAH, GA.—Announcement has been made that the Bell Telephone Company has purchased the plant and holdings of the Georgia Telephone Company. The City Council and State Railroad Commission will be asked to sanction the merger.

VIDALIA, GA.—The contract for the construction of the municipal electric light plant has been awarded to J. B. McCrary & Company, of Atlanta.

SPIRIT LAKE, IDA.—Plans are being made by the Idaho & Washington Northern Railroad Company for the construction of machine shops in this place. The machinery in the shops will be operated by electricity, generated in the company's plant, which will be erected primarily for the purpose of supplying energy for operating the planing mill of the Panhandle sawmill, now under construction. The plant will also furnish electrical energy for lighting the mill and the town of Spirit Lake.

GRANT PARK, ILL.—The City Council is reported to be contemplating installing a new street lighting system.

HAMPSHIRE, ILL.—The municipal electric light plant has been purchased by Louis Koth, who will operate it under the name of the Hampshire Electric Light Company. Mr. Koth contemplates building a new power house this spring and will install a new boiler and possibly an engine and other equipment.

DECKER, IND.—Plans are being prepared by B. von Schon, of Detroit, Mich., consulting engineer for the Hydro-Electric Company, of Vincennes, to develop the water power of the White River near this point. Eugene Rush is president of the company.

FAIRMONT, IND.—The Central Indiana Lighting Company, a company formed last year to take over the light plants of a number of Indiana cities, has secured the right-of-way for a high-tension transmission line to furnish Alexandria, Columbus, Fairmont and Jonesboro with electricity for lamps and motors. The price will be $20 each per year for 32-cp incandescent lamps.

MT. VERNON, IND.—The Common Council will receive bids until April 1 for lighting the streets of the city with electricity for a term of ten years, beginning July 1, 1909, the street lighting system to consist of 85 arc lamps of 2000 cp each. A franchise for commercial and residence lighting for 11 years will be included with the contract for street lighting. Henry Kling is city clerk.

NOBLESVILLE, IND.—The water power plant which was partially built near this place in 1904 is to be completed this year in accordance with revised plans being prepared by B. von Schon, of Detroit, Mich., consulting engineer. The plant will supply electrical energy in Noblesville.

SPENCER, IND.—E. R. Bladen, receiver, is asking for bids for all the property, including poles, wiring system and franchise, of the Spencer Electric Light Company. Bids will be opened Feb. 21.

MILLER, IND.—The Town Board has granted a franchise to T. E. Bell, of Hammond, for an electric light and gas plant for a term of 25 years.

VERMILLION, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has taken a contract to light the town. G. F. Grover, manager of the company, announces that improvements will be made on the local lines in Terre Haute this year, the cost of which is estimated at $75,000.

VINCENNES, IND.—The Vincennes Traction & Light Company contemplates extensive additions and improvements to its plant, including the enlargement of the power house and extension of service to a new factory district. The company has authorized an issue of $100,000 in capital stock.

FORT DES MOINES, IA.—Bids will be received until Feb. 24 for furnishing and installing electric wiring, electric light fixtures, etc., complete, in one double set captain's quarters and two double sets lieutenant's quarters to be constructed at Fort Des Moines. Further information furnished on application to Captain John J. Boniface, constructing quartermaster.

LEON, IA.—The Decatur County Mutual Telephone Company is making arrangements to remodel and improve the local exchange which it recently purchased.

PERRY, IA.—The Hawkeye Telephone Company is contemplating the erection of an exchange building, the cost of which is estimated at $20,000.

SHEFFIELD, IA.—The City Council is reported to be considering the question of establishing a municipal electric light plant.

BARBOURSVILLE, KY.—It is reported that the Cumberland Ice & Beverage Company has purchased the plant of the Barboursville Electric Light Company.

MOREHEAD, KY.—The City Council on Jan. 27 awarded the contract for the construction of an electric light plant, the equipment of which includes a 480-hp engine, 50-kw, single-phase generator, 80-hp boiler, etc. The plant will cost about $5,000. The Reliance Engineering Company, of Cleveland, Ohio, has charge of the construction of the plant.

OAKLAND, KY.—The City Council has passed a resolution revoking the permit and ordering the Cumberland Telephone Company to vacate the streets and alleys of the city. It is understood that the town wants the company to pay $400 for a new franchise.

ATHENS, LA.—The Athens Progressive League is endeavoring to secure the installation of an electric light system in the town. E. A. Watson is president of the league.

ASHLAND, ME.—A movement is on foot to have the town lighted by electricity to be furnished by the plant at Aroostook Falls.

BOSTON, MASS.—A bill has been filed petitioning the Legislature to authorize the construction of a 12-ft. dam across the Connecticut River at Gill, and the incorporation of the French King Rapids Power Company, organized for the purpose of erecting an electric power plant at that place to distribute electrical energy in Worcester County and the towns of Irving, Warwick, Gill and Northfield in Franklin County. The petitioners named are: Philip Young, Henry I. Harriman and Joseph O. Proctor, Jr.

BROOKLINE, MASS.—The citizens have voted to authorize the committee on municipal lighting to secure expert assistance to be used in completing its investigation, and to appropriate $2,000 to pay for the same. It was also voted to authorize the Selectmen, if they deem expedient, to appear before the Board of Gas and Electric Light Commissioners for the purpose of obtaining reduction in the prices for electricity furnished in the town by the Boston Consolidated Gas Company.

WESTON, MASS.—The Weston Electric Light & Water Company is extending its transmission lines to Stony Brook to furnish electricity for lamps.

WHITMAN, MASS.—The local electric light plant has been closed down and electrical energy for operating the local system is transmitted from the new plant just completed at East Bridgewater by the Stone & Webster Company.

MARQUETTE, MICH.—C. W. Humphrey, of Chicago, Ill., has been secured to make an examination of the municipal electric light plant, with a view of making a number of changes.

MIDLAND, MICH.—Plans and specifications are being prepared by B. von Schon, of Detroit, Mich., consulting engineer, to develop the water power of the Chippewa River near this place.

NILES, MICH.—The Indiana & Michigan Electric Company, of South Bend, Ind., has been granted a franchise by the City Council permitting the company to furnish electricity to manufacturing and other establishments in this city. The Council refused the company a franchise some time ago, but recently asked the company to renew its application. The grant is for 30 years and permits the company to furnish electricity for lamps only upon the consent of the Council, which is done to protect the municipal lighting plant.

PELLSTON, MICH.—The Pellston Light & Power Company will let contracts for the following equipment: One 200-kw alternating current generator direct connected to a water wheel; galvanized iron sheet piling, construction of cement dam and 20 miles of 25,000-volt transmission line to be used in connection with the line now in operation. The plant is situated on the Escanaba River. F. E. Hatch is vice-president and manager.

EVELETH, MINN.—A committee has been appointed by the City Council to investigate the question of establishing a municipal electric light plant. It is proposed to install engines, boilers and electrical machinery in the water-power plant to supply electricity to light the city. At present the city is provided with electricity for lighting by a private corporation, which is said to have a contract for three years, which certain factions assert can be annulled.

JACKSON, MINN.—Bids will be received until March 4 by the Board of County Commissioners, at the office of P. D. Kellar Company, auditor, for installing electric light fixtures in the new court house, the cost not to exceed $1,600.

ST. PAUL, MINN.—Edward G. Krahmer, county auditor, writes that the contract for heating and lighting the county jail and furnishing energy for operating the elevators has been awarded to the St. Paul Gas & Light Company. The contract is for three years at $3,780 per year.

GOLDFIELD, NEV.—The Nevada-California Power Company is erecting a duplicate transmission line from Bishop to Goldfield, thus insuring a continuous service and greatly increasing the supply of electricity furnished in this place and Tonopah. It is expected to have the line completed within 60 days.

PARK RIDGE, N. J.—Bids will be received until Feb. 17 for improvements to the municipal electric light plant, including the rebuilding of dyke well, re-enforcing and raising height of dam, building concrete spillway, grading and filling around storage reservoir, and installing a 30-kw, gasoline-driven, direct-connected unit. George T. Hanchett, 237 Fulton Street, New York, N. Y., is the engineer.

VINELAND, N. J.—The State Legislature has reported favorably on the petition asking for an appropriation of $20,000 for a new heating and lighting plant for the New Jersey Home for Disabled Soldiers at Vineland.

AVOCA, N. Y.—The Village Board has granted a 20-year franchise to the Bath Electric Light & Power Company to furnish this village with electricity for lamps and motors. E. J. G. Tower, general manager of the company, states that the company will furnish electricity for lamps for commercial and private use at a price not to exceed 10 cents per kilowatt hour, and for arc lamps for street lighting with an all-night service at a cost not to exceed $62.50 per lamp per year.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company has awarded the contract for the construction of the extension to its power house at Main Street and Gowanus Canal. The contract for the electrical equipment has been awarded to the General Electric Company, of Schenectady, and for boilers to the Babcock & Wilcox Company, New York. J. L. Heins is general manager of the railway company.

CANANDAIGUA, N. Y.—A new dynamo has been installed in the Littleville plant of the Ontario Light & Traction Company, which will improve the lighting service.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 29, for one alternating-current electric elevator complete, two alternating-current electric elevator machines and three alternating-current belted motors, for the navy yard, New York, N. Y. Plans and specifications can be seen at the bureau or will be furnished by the commandant of the New York Navy Yard. R. C. Hollyday is chief of bureau.

SCHAGHTICOKE, N. Y.—The Schaghticoke Electric Company has purchased the property of the Schaghticoke woolen mills at this place, which were sold at auction Jan. 24, for $30,000. The company is developing the water power in the Hoosick River at Buck's Neck, near Schaghticoke, and will utilize the water power of the Schaghticoke mills. George E. Green, of Hoosick Falls, is president of the electric company.

SOUTHFIELDS, N. Y.—A water power is being developed on the Nombashaw near the Sterling Furnace. A concrete dam is now being constructed and the power plant will be located in the old furnace. The electrical energy will be utilized in Southfields. H. von Schon, of Detroit, Mich., has charge of the construction work.

WEST POINT, N. Y.—Bids will be received until Feb. 20 by the quartermaster, West Point, for furnishing and installing electric light fixtures in gun shed, artillery stable, cavalry stable, artillery barracks and cavalry barracks at West Point.

HIGH SHOALS, N. C.—The High Shoals Company has contracted with the Southern Power Company for electrical energy to supplement that generated by the local plant, which will enable the company to operate additional machinery.

NEWTON, N. C.—The Southern Power Company, of Charlotte, has just completed its transmission lines to this place. A sub-station has been built, and energy will be supplied to the Newton Hosiery Mills, the Catawba Cotton Mills and other industrial plants. The Ridgeway mills, when completed, will also use electrical energy.

RALEIGH, N. C.—The Agricultural and Mechanical College is installing an electric plant to furnish electricity for lamps, heat and motors to the various college buildings.

ROCKINGHAM, N. C.—The recent heavy rains completely destroyed the coffer dam at the electric power development at Bluitt's Falls, on the Great Peedee River, near Rockingham. The damage is estimated at approximately $25,000.

SALISBURY, N. C.—The Whitney Reduction Company is extending its transmission lines in all directions from this city and will complete the line to High Point, 40 miles distant, by July 1, building one direct line, and one via Salisbury, Lexington and Thomasville, in order to insure a continuous service.

CINCINNATI, OHIO.—It is reported that the plan to use the banks of the Miami and Erie Canal for an electric railway may be revived. The Supreme Court in Columbus has affirmed the decision of the lower court in the matter of enjoining the State Board of Public Works from removing the equipment of the Miami & Erie Canal Transportation Company from the banks.

DORSET, OHIO.—The capital stock of the Dorset Telephone Company has been increased from $3,000 to $10,000.

WARREN, OHIO.—The Peerless Electric Company has secured control of two dams at Newton Falls and one at Leavittsburg, on the Mahoning River, and one at Parkman, on the Grand River, which will have an aggregate of 1900 hp. It is the intention of the company to build a large generating plant which will have twice the output of its present plant in the city. The company has increased its capital stock from $500,000 to $700,000.

TOLEDO, OHIO.—An ordinance has been introduced in the City Council providing for the repeal of the heating and power franchise granted the People's Heat & Power Company, of which Homer T. Yaryan was the head. Mr. Yaryan claims that the old Council promised him an electric light franchise and failed to pass it before the members went out of office. The new Council is not bound by this promise, and, since he would not endeavor to operate without a lighting franchise, the matter will be dropped.

YOUNGSTOWN, OHIO.—Plans have been prepared by the Central Union Telephone Company for the complete reconstruction of its system

in this city. The improvements contemplated include the placing of its wires underground in the business portion of the city and rebuilding the overhead lines with copper wire and replacing the old instruments with new equipment.

GOLD HILL, ORE.—The Gold Hill Canal Company will make extensive improvements upon its plant as soon as weather conditions will permit. E. C. Thompson is general manager.

SALEM, ORE.—Attorney John H. McNary has filed in behalf of the Portland, Eugene & Eastern Railway Company a notice of appropriation of 2000 cu. ft. of water per second from the McKenzie River, in Lane County.

JOHNSTOWN, PA.—Plans are being made by the Johnstown Passenger Railway Company for extensive improvements to its system involving an expenditure of about $100,000, of which $62,000 will be used to construct a new system in the Morrellville district.

PITTSBURG, PA.—Mayor George W. Guthrie, in his annual message, recommends placing the overhead wires in underground conduits, particularly in the business section of the city.

PITTSBURG, PA.—Announcement has been made by Mayor George W. Guthrie that plans will be changed for the proposed power plant at the city poor farm at Marshalsea and the contract readvertised.

ROYER, PA.—The Morrison Cove Electric Light & Power Company contemplates installing a hydro-electric plant, bids for which will probably be received in March. The plant will furnish electricity for lamps in Martinsburg and Williamsburg, and also for motors to operate the crushers at Royer and vicinity. Complete equipment for the plant and about 12 miles of transmission line will be required; also 25 arc lamps and from 1800 to 2500 16-cp incandescent lamps will be needed. The cost of the plant is estimated at $45,000. Frank W. Moore, of Indiana, is engineer.

SUNBURY, PA.—The Middlecreek Electric Company has decided to furnish electricity in Sunbury for lighting, and has placed contracts for enlarging the Northumberland plant and for the installation of new machinery. These improvements will give the plant sufficient output to furnish electrical energy for lighting in Northumberland and Selinsgrove as well as Sunbury, and also for operating the electric railway. The company is erecting transmission lines in Sunbury and expects to be ready for business in a short time.

EBENEZER, TENN.—Arrangements are being made by O. Knudson to erect an electric plant to furnish electrical energy to operate his mill and residence, and will also furnish electricity to the town of Concord, two miles distant. The contract for wiring has been let to the Acme Electric Company, of Knoxville.

NASHVILLE, TENN.—The improvement and expenditure committee of the City Council has acted on the measures appropriating $100,000 for enlarging the municipal electric light plant of this city. It is provided that the Board of Public Works, with the assistance of the Building Inspector, shall prepare plans for the addition to the plant.

SEVIERVILLE, TENN.—Messrs. McMahon & Walker will shortly establish an electric light plant here.

SWEETWATER, TENN.—The Telephone & Improvement Company is contemplating the purchase of a generator and other electrical machinery for its electric plant.

DENISON, TEX.—The Denison Electric Lamp & Power Company contemplates installing an electric driven triplex pump. N. J. Wheeler is manager.

FORT WORTH, TEX.—Work will soon commence on the improvements to the power plant of the Northern Texas Traction Company in Handley. A new 1500-hp engine, two boilers and a 1125-kw generator, together with the necessary pumps, condensers, etc., will be installed. The work will involve an expenditure of about $150,000.

HOUSTON, TEX.—The Woods Electric Company, of Houston, has changed its name to the Tel-Electric Company.

SHERMAN, TEX.—The North Texas Telephone Company, of this place, has increased its capital stock from $40,000 to $52,000.

MONTPELIER, VT.—The City Council has granted a franchise to Almon & Moody to erect transmission lines for the distribution of electricity within the city limits. The company owns an electrical plant on the Mad River in Moretown.

BARNET, VT.—The local electric light plant was recently destroyed by fire.

ARVONIA, VA.—D. W. Pierce, of Arvonia, writes that he will receive bids until Feb. 20 for the construction of an electric power plant. The cost of the plant is estimated at $175,000.

MANCHESTER, VA.—The State Legislature has passed a bill authorizing the town to enlarge the municipal electric light plant.

CHEHALIS, WASH.—The Chehalis & Centralia Railway & Power Company has purchased the power plant, cars, road, etc., of a defunct railway which now connects two small cities near Los Angeles, Cal., and will move the entire plant and equipment to Chehalis to be used in connection with its line between Chehalis and Centralia.

PROSSER, WASH.—Arrangements are being made by the Prosser Traction Company to begin construction work in the spring. The company has secured a site for a power plant on the Yakima River, a short distance below Prosser.

SEATTLE, WASH.—The Pacific Coast Power Company, allied with the Seattle Electric Company, has purchased the lands held on the White River by the Seattle-Tacoma Power Company. According to a statement made by Jacob Furth, president of the Seattle Electric Company, the Pacific Coast Company will immediately develop 100,000 horse-power at a plant to be erected on the White River, which will be transmitted to Seattle and Tacoma.

SEATTLE, WASH.—Bids will be received until Feb. 15 by C. B. Bagley, secretary of the Board of Public Works, for the construction of a system of cluster lamps on Third Avenue, the cost of which is estimated at $51,200.

SPOKANE, WASH.—The new steam power plant of the Washington Water Power Company, which has been in operation for a short time, has been closed down, as the extra energy is not needed at this time. The company's new high tension line to the Cœur d'Alenes is practically completed.

BARRON, WIS.—The Council is contemplating purchasing additional machinery for the municipal electric light plant.

BLOOMER, WIS.—The capital stock of the Bloomer Telephone Company has been increased from $1,500 to $3,000.

JANESVILLE, WIS.—The County Board has adopted a resolution instructing the purchasing committee to look into the advisability and secure estimates of the cost of installing a lighting plant in the jail building to be owned by the county.

LA CROSSE, WIS.—The La Crosse Interurban Telephone Company has purchased the lines of the Vernon County Telephone Company and has consolidated the two systems. The Vernon County lines consist of about 600 telephones with exchanges at Viola. The headquarters of the company will be in La Crosse.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has decided to make extensive improvements and extensions to its system during the ensuing year, which will involve an expenditure of $750,000. It is planned to extend the toll lines in the northern part of the state, adding circuits to existing lines and making improvements wherever needed.

MILWAUKEE, WIS.—The City Council has adopted a resolution to give the people another opportunity at the election next spring to vote on the question of building a municipal electric light plant.

MONROE, WIS.—The special committee appointed by the City Council to investigate the question of lighting the town and to make a new contract with the Monroe Electric Light & Power Company recommends that the city do its own street lighting unless better terms can be made with the electric company.

WAUSAU, WIS.—The directors of the Wausau Street Railway Company are negotiating for the plant and holdings of the Wausau Electric Company and are also contemplating the purchase of the water power of Little Bull Falls at Mosine. The Wausau Street Railway Company is planning to get possession of the principal water powers in this section of the Wisconsin River valley with the ultimate purpose of generating and distributing electricity throughout this section of the valley.

ALBERNI, B. C., CAN.—Application will be made to the Legislative Assembly at its next session for an act to incorporate a company with power to generate, transmit and distribute electricity within a radius of 12 miles of the town of Alberni, Vancouver Island; also the right to construct and operate tramways, railway and telephone systems within the said radius.

NEW WESTMINSTER, B. C., CAN.—G. H. Halse, superintendent of the British Columbia Telephone Company, states the telephone system in this city will be placed in conduits and the switchboard capacity increased to 3000.

HONOLULU, HAWAII.—James A. Coke, of Maui, is in Washington, D. C., looking after a franchise for the installation of an electric plant on Maui. The proposed power plant will supply electricity to the towns of Lahaina and Kahuli, also to several plantations, for motors.

EUGENIA, ONT.—The tunnel for the water power development of the Georgian Bay Water Power Company at Eugenia has been completed and the dam and power house will be built this year. Considerable 54-in. steel plate pipe will be required for this work. The electrical energy will be transmitted to Owen Sound, 35 miles distant. H. von Schon, of Detroit, Mich., has charge of the construction of the plant.

HAMILTON, ONT.—A special committee has been appointed by the City Council to consider the form of contract, the price of electrical energy, etc., in connection with the proposed municipal electric light plant; also the appointment of an electrical engineer to prepare specifications for the plant.

MONTREAL, QUE., CAN.—The Trustees of McGill University are considering the question of installing an independent light, heat and power plant at the university.

SHERBROOKE, QUE.—At the annual meeting of the Sherbrooke Power, Light & Heat Company held recently, it was voted to sell the company's plant and business to the city.

VERA CRUZ.—The local government has asked for bids on electrical installation for all public buildings. It is planned to install electric lamps in the near future.

New Industrial Companies.

THE TURBINE MOTOR COMPANY, of Babylon, N. Y., has been incorporated, with a capital stock of $12,000, by Paul Keanse, Joseph Covert and David Sandman, of Babylon, N. Y.

THE ENTERPRISE ELECTRIC COMPANY, of Warren, Ohio, has been incorporated, with a capital stock of $25,000, by F. P. McBerty, C. B. McCurdy, N. H. Cobb, J. C. Ewalt and R. A. Cobb.

THE CLEVELAND SPARK PLUG COMPANY, of Cleveland, Ohio, has been incorporated, with a capital stock of $10,000, by H. L. Smith, J. D. Chambers, J. R. McQuigg, C. B. Riley and Louis E. Hatch.

THE ELECTRIC REALTY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,500 by William S. Paine, Louis H. Guterman and Herman Hare, of New York, N. Y.

GOOD & CRAFT, INC., of Baltimore, Md., has been incorporated, with a capital stock of $8,000, to manufacture gas and electric fixtures. The incorporators are Abraham J. Good, Elizabeth H. Good, Charles L. W. Craft and others.

THE N. S. U. MOTOR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000. The directors are Gottleb Banzhaf, Neckarsulm, Germany; Eugene Keiherer and Carl L. Schurz, of New York, N. Y.

THE HERALD ELECTRIC COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $2,000, by Clement G. Harrington, Anna L. Jacobs and Richard S. McCully. The company proposes to do a general electrical business.

THE MARKO STORAGE BATTERY COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The directors are Paul M. Marko, Herman Mattfield, of Brooklyn; Charles Standt, of West Hoboken, N. J.

THE GEORGE V. LYONS MOTOR COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $3,000. The directors are Marie A. Lyons, George V. Lyons and Andrew G. Dickson, of New York, N. Y.

THE FEDERAL SIGNAL COMPANY, of Colonie, N. Y., has filed articles of incorporation with the Secretary of State with a capital stock of $2,000,000. The directors are: Frederic Pruyn, of Londonville; Augustus Veghte, of Albany, and James H. Caldwell, of Troy.

THE QUEEN CITY ELECTRIC COMPANY, of Sedalia, Mo., has been incorporated with a capital stock of $2,000 for the purpose of establishing an electrical engineering and contracting business. James A. Capen is president and W. F. Potter secretary and treasurer.

THE STANDARD AUTOMATIC ELECTRIC COMPRESSING COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $100,000. The directors are Ellis F. Browne, president; Frederick L. Hopkins, treasurer. The company proposes to deal in machinery, etc.

THE HOLLAND ELECTRIC PUMP & ENGINEERING COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $60,000. The directors are Eugene Higgins, Leonard L. Wetmore, Englewood, and Frank W. Wetmore, of Newark, N. J.

THE GRAVITY LOCKOUT COMPANY, of Toledo, Ohio, has been incorporated, with a capital stock of $50,000, for the purpose of manufacturing a new patented telephone device for use on party lines. George A. Ford is president of the company, Floyd Oull secretary and J. V. Newton treasurer.

THE BORUM & WHITING COMPANY, of New Orleans, La., has been incorporated with a capital stock of $15,000 for the purpose of dealing in electrical fittings, etc. The officers of the company are: W. G. Borum, president; Ruy D. Whiting, vice-president, and Walter L. Parker, secretary and treasurer.

THE STEWART ENGINEERING COMPANY, of Newark, N. J., has filed articles of incorporation with the Secretary of State. The capital stock of the company is placed at $25,000 and the incorporators are Sheelman T. Stewart, Willard Demsey and Arthur M. Woodford. The company proposes to do an electrical and mechanical engineering business.

Company Elections.

SPRINGDALE, ARK.—At the annual meeting of the North Arkansas Telephone Company the following named officers were elected: D. Christian, president; Benjamin Greer, vice-president; James Steele, secretary, and Edgar Masoner, treasurer.

MILFORD, IND.—At the annual meeting of the Royal Telephone Company the following named officers were elected: J. B. Neff, president; L. M. Neher, secretary; C. A. Sparkling, treasurer.

SWEETSER, IND.—At the annual meeting of the Sweetser Rural Telephone Company the following named officers were elected: William Glessener, president; Riley O. Malott, secretary; Benjamin Shields, treasurer, and Tilden Chandler, manager.

AUGUSTA, ME.—At the annual meeting of the Kennebec Light & Heat Company the following named officers were elected: George F. West, president; Samuel Cony, treasurer and clerk, and William H. Williams, superintendent.

WINONA, MINN.—At the annual meeting of the Homer Ridge Telephone Company the following named officers were elected: O. S. Bundy, president; C. W. Merritt, vice-president; J. H. Johnson, secretary and treasurer.

ST. LOUIS, MO.—At the annual meeting of the Union Electric Light & Power Company the present board of directors was re-elected, as follows: John I. Beggs, Adolphus Busch, August Gehner, Breckenridge Jones, Charles F. Pfister, W. N. V. Powelson, G. R. Sheldon, Julius S. Walsh and C. W. Wetmore.

ST. LOUIS, MO.—At the annual meeting of the Laclede Gas Light Company John I. Beggs was re-elected president, August Gehner was elected vice-president to succeed Breckenridge Jones, and P. E. Bisland, of New York City, was also elected vice-president. The other officers are C. L. Holman, secretary; W. S. Dodd, treasurer; W. F. Kroyer, of New York, N. Y., assistant secretary, and E. B. Pray, of New York, N. Y., assistant treasurer.

BUFFALO, N. Y.—At the annual meeting of the Frontier Telephone Company all the present officers were elected with the exception of Secretary Byron L. Moore. G. Barrett Rich, Jr., was elected to succeed Mr. Moore.

PATCHOGUE, N. Y.—At the annual meeting of the Suffolk County Telephone Company the following named officers were elected: H. Clay Losee, president; Fremont Hammond, vice-president; Daniel Chichester, secretary, and John E. Ketcham, treasurer.

BLOOMVILLE, OHIO.—At the annual meeting of the Farmers' Telephone Company the following named officers were elected: Fred Hutchinson, of Clyde, president; I. C. Gray, of Bloomville, vice-president; C. C. Bronson, of Clyde, secretary; F. S. Bronson, of Bloomville, treasurer and general manager.

CLEVELAND, OHIO.—At the annual meeting of the Cleveland Electric Railway Company the following named officers were elected: Horace E. Andrews, president; J. J. Stanley and C. F. Emery, vice-presidents; H. J. Davis, secretary, and George S. Russell, treasurer.

CRESTLINE, OHIO.—At the annual meeting of the Crestline Telephone Company the following named officers were elected: Jacob Babst, president; F. A. Knapp, vice-president and general manager; Ralph Wolfram, secretary; A. H. Kinsey, treasurer.

NEWARK, OHIO.—At the annual meeting of the Newark Independent Telephone Company the following named officers were elected: Harry Swisher, president; John C. Brennan, vice-president; C. H. Spencer, secretary, and Edward Kibler, treasurer.

JOHNSTOWN, PA.—At the annual meeting of the Northern Cambria Street Railway Company the following named officers were elected: W. H. Denlinger, president; James H. Allport, secretary; H. F. Bigler, treasurer.

MARION CENTRE, PA.—At the annual meeting of the Farmers' Telephone Company the following named officers were elected: M. T. Steele, president; H. L. McCullough, vice-president; S. J. McManus, secretary.

SHAMOKIN, PA.—At the annual meeting of the Shamokin & Edgewood Electric Railway Company the following named officers were elected: Monroe H. Kulp, president and general manager; G. Gilbert Kulp, vice-president; M. H. Barr, secretary and treasurer.

YORK, PA.—At the annual meeting of the York Railways Company, the York & Maryland Line Street Railway Company, the York Steam Heat Company, the York Suburban Land Company, the Westinghouse Electric Light, Heat & Power Company and the Edison Electric Light Company, W. F. Bay Stewart was chosen president and the following directors were elected: George H. Frazier, of Philadelphia; John C. Dawson, of Philadelphia; Thomas Newall, of Philadelphia; J. C. Schmidt and Francis Farquhar, both of York.

MILBANK, S. D.—At the annual meeting of the Grant County Telephone Company the following named officers were elected: F. B. Roberts, president; John Heffernan, vice-president; J. C. Reeve, secretary, and John Nord, treasurer.

MARTIN, TENN.—At the annual meeting of the Weakley County Telephone Company the following named officers were elected: S. H. Hall, president; T. M. Ryan, vice-president; G. W. Hall, secretary and treasurer.

PARKERSBURG, W. VA.—At the annual meeting of the Parkersburg, Marietta & Interurban Railway Company the following named officers were elected: C. H. Shattuck, president; W. W. Van Winkle, secretary; C. C. Martin, first vice-president; W. W. Mills, second vice-president; Thomas Logan, treasurer.

New Incorporations.

YUMA, ARIZ.—A. H. Womble states that if the government will grant water-power concessions on the Colorado River to an English syndicate he will install a 1000-hp power plant on the river and transmit the energy to Kofa to operate a 4000-ton mill.

GRASS VALLEY, CAL.—The North Yuba Electric Light & Power Company has been incorporated, with a capital stock of $1,000,000, by S. B. Crane, W. B. Barstow and Earl Talbot.

HANFORD, CAL.—Articles of incorporation have been filed for the Hanford & Lemoore Interurban Railway Company. The capital stock of

the company is $1,000,000 and the officers are: A. V. Taylor, president; F. S. Granger, vice-president and manager; W. J. M. Cox, secretary, and Judd Smith, treasurer.

UKIAH CITY, CAL.—The Clear Lake Telephone & Telegraph Company has been incorporated, with a capital stock of $50,000, by H. S. Johnson, A. H. Spurr, L. J. Shuman, M. S. Sayre and F. L. Wright.

WILMINGTON, DEL.—The West Chester & Wilmington Electric Railway Company has been chartered with a capital stock of $200,000. The capital stock of the Pennsylvania end of the line is $300,000 and a charter for that company was granted some time ago. The incorporators of the Delaware company are: Thomas E. O'Connell, C. P. Faucett, Dr. F. Harvey, Isaac C. Elliott and Howard D. Ross. It is said that the company will begin operations on the Wilmington end of the line as soon as the weather permits. It is understood that the power house will be erected at Brandywine Summit.

CŒUR D'ALENE, IDAHO.—The Rimrock Water, Light & Power Company has been incorporated with a capital stock of $150,000. The officers of the company are: George W. Mason, president and general manager; P. J. Scallon, first vice-president; C. W. Craik, second vice-president; W. W. Leeper, secretary, and S. G. Sargent, treasurer.

WEST LEBANON, IND.—The Farmers & Merchants' Co-operative Telephone Company has incorporated, with a capital stock of $30,000. J. H. Brener, W. M. White and George W. Day are the directors.

JACKSON, MISS.—The Mississippi Home Telephone Company has been incorporated, with a capital stock of $250,000. The incorporators are Geo. C. Graeber, Shamokin, Pa.; W. L. Heifenstein, Shamokin, Pa.; N. D. Smith, Meridian, Miss.; J. O. Spoots, of Jackson, Miss., and C. M. Williamson, of Jackson, Miss.

FERGUSON, MO.—The Ferguson Electric Light & Supply Company has been organized, with a capital stock of $15,000. J. Goode Cabanne is interested. The company will be co-operative, all the stock being sold to residents of Ferguson, and the rate charged will be 10 cents per kw-hour. The price now charged for electric service is 15 cents per kw-hour.

LIBERTY, N. C.—The Liberty Telephone Company has been chartered, with a capital stock of $25,000, by J. L. Hardin and others.

SEWARD, N. C.—The Doesler Telephone Company, Forsyth County, N. C., has been chartered, with a capital stock of $9,000.

PENDLETON, ORE.—Articles of incorporation have been filed with the Secretary of State for the Cottage Grove Electric Company with a capital stock of $50,000, by John H. McNary, E. N. Hall and A. Welch.

AKRON, OHIO.—The Imperial Electric Company, of this city, has been incorporated, with a capital stock of $180,000, by E. E. Andrews, R. E. Inskeep, William Weaver, W. C. Hall and A. C. Sinzee.

EASTMAN, WIS.—The Sioux Coulee Mutual Telephone Company has been incorporated by William Arlington, J. C. Stagman, E. E. Thomas, Charles R. Young and I. W. Brink.

COLDSTREAM, ONT., CAN.—The Lobo Telephone Company has been incorporated, with a capital of $10,000. The incorporators are N. A. Graham, D. A. Graham, A. J. Graham, A. Stoner, J. A. Smith, A. E. McKay, F. L. Graham, H. J. Marsh, J. Marsh and D. R. Owens, of Lobo Township.

Personal.

DR. A. G. BELL is among the bidders for the airships required by the U. S. Signal Corps for army service.

DR. EDWARD WESTON has been elected a member of the board of trustees of the Stevens Institute of Technology.

MR. ROBERT McDOBLE, the consulting and supervising engineer, has removed his office from Colorado Springs to Denver, Colo.

MR. W. DE LA BARRE, the engineer and manager of the St. Anthony Falls Water Power Company, has declined a flattering offer to go to Japan in charge of some new hydroelectric enterprise there.

MR. R. H. TILLMAN, a graduate of the North Carolina State College, has left the testing department of the General Electric Company and has joined the forces of the Rochester Railway Company, of Rochester, N. Y.

MR. EARL ENGLISH, an alumnus of Stevens Institute, has left the testing department of the General Electric Company, at Schenectady, to accept a responsible position with the Public Service Corporation of New Jersey.

MR. F. E. BOWMAN has been appointed manager of the Ada, Okla., Electric & Gas Company. He was formerly active in the management of the Huntington, Ind., Light & Fuel Company, but has a strong faith in the new West and is going to grow up with it.

MR. J. W. ALLING has been elected president of the Southern New England Telephone Company and James T. Moran vice-president. Mr. Alling fills the vacancy caused by the death of Morris F. Tyler, and Mr. Moran takes the place of James English, who declined to serve longer on account of other business.

MR. MARSDEN J. PERRY has resigned as president and general manager of the Narragansett Electric Lighting Company, after twenty years of active connection with the enterprise, which he has built up into a great institution in spite of the attention needed by his other large interests. Mr. Perry served one year very efficiently as president of the National Electric Light Association.

MR. N. MINER, who was until recently connected with the Union Electric Company in Dubuque, Ia., in the capacity of manager of the new business department, has resigned to accept a similar position with the Topeka Edison Company, of Topeka, Kan. Mr. Miner received his early training in this work with the Denver Gas & Electric Company. He was for some time with the Curtis Advertising Company, of Detroit.

MR. ALEX ROTHERT, who has been an electrical engineer on work in Russia, for the Westinghouse interests, and more recently has been engaged in other electrical enterprises in Great Britain, has made a trip to this country and will spend a couple of months studying developments in this country. He has contributed to these pages from time to time and is well known on both sides of the Atlantic for his work in connection with alternating current motors.

MR. CALE GOUGH, an engineering journalist well known from his connection with the McGraw publishing interests and more recently representing the *Street Railway Journal* in Chicago, has taken over and will operate the light and water plant at Lawrenceville, Ill., from February 1. Mr. Gough has shown great aptitude for the central station side of the electrical industry and may be trusted to develop his plant to a high efficiency.

LIEUT.-COMMANDER DAVIS, U. S. N., wireless telegraph expert of the Navy Department, fears that our Senate may refuse to ratify treaties securing general wireless intercommunication among the navies of the world. He is quoted as saying that the efforts of one of the wireless companies "to establish a monopoly in wireless telegraphy" are liable to leave our vessels "without standing in the wireless world, unable to transmit or receive important messages."

DR. E. B. ROSA, the physicist, who has had special care of the electrical work in the new Bureau of Standards in Washington and has already secured some admirable results at that useful institution, sailed last week for Europe, where he will spend three or four months in a study of the latest methods in national and university laboratories and will give particular attention to methods for harmonizing and universalizing standards of light in the gas and electric industries on both sides of the water.

MR. WALTER T. PECK, of New York, has been commissioned by the Chilean government to make a comparative study of railroads operated by steam and roads operated by electricity in this country. Mr. Peck, who graduated from the Institute of Technology with the class of 1893, came to this city from Chile, where he has business interests, a month ago, and will return to Valparaiso about the first of March. United States Consul Alfred A. Winslow, of Valparaiso, is the authority for the announcement that the Chilean government is considering the feasibility of replacing the second section of the state railroads which are operated by steam by an electrical service. The present cost of operating the government roads is very heavy, as nearly all the coal used is imported from England. The Cordilleras mountains, with their regions of perpetual snow, furnish numerous streams that are crossed by the second section of the railroad, and which, with their ample falls, seem to furnish excellent opportunities for unlimited water power. The first section, which is about 100 miles in length, connects Valparaiso with Santiago, and the second section is about 350 miles long and extends from Santiago to Concepcion.

Obituary.

MR. WARREN F. WALWORTH, of Cleveland, Ohio, founder of the Walworth & Neville Manufacturing Company, died at his home in that city recently.

MR. DANIEL SHAFER.—On Jan. 24, Mr. Daniel Shafer, for many years one of the best known salesmen and engineers in the South, succumbed to a sudden attack of pneumonia at the Nashville Hotel, Nashville, Tenn. Mr. Shafer, who was 47 years of age at his death, had been associated for the past three years with the Allis-Chalmers Company, of Milwaukee, being attached during a portion of that time to the pumping engine department, and for the past year as sales engineer of the steam turbine department. For five years previous to taking his position with the Milwaukee company he was associated with the Hoovens-Owen Rentschler Company, of Hamilton, Ohio, during which time he acted as their Southern representative.

Trade Publications.

ELECTRIC PYROMETERS.—Catalogue No. 20 of William H. Bristol, 45 Vesey Street, New York, describes and illustrates indicating, recording and combination electric pyrometers for blast furnaces.

CAR SPRINGS for steam railroads and electric traction service are described in a catalogue issued by the Standard Steel Works, Harrison, Building, Philadelphia, Pa.

PORTABLE GAS-FLAME HEATERS for pieces that are too heavy to be removed to a furnace are described in Bulletin No. 13, issued by the Rockwell Engineering Company, 26 Cortlandt Street, New York.

"GOOD LUCK" CALENDAR.—Harvard Electric Company, of Chicago, 66 West Van Buren Street, has issued this month to its customers "Good Luck" cards, with a little calendar, which can be had on application.

ELECTRICAL CONDUITS.—A very neat little pamphlet on conduits and fittings has just been issued by Gilpin V. C., of 120 Liberty Street, New York. It is quite an interesting epitome of this class of material in which Mr. Gilpin specializes so successfully.

OHIO BRASS COMPANY, Mansfield, Ohio, has issued a booklet on its types B and C Collin pressure regulating valves. This is a new valve it has just placed on the market, and one which it believes should find considerable application in electric power plants.

SWITCHBOARD EQUIPMENT COMPANY.—Mr. J. L. Merrill, of Pittsburg, formerly district manager for the General Electric Company in the Pittsburg district, is now handling the switchboard equipment circuit breakers of the Switchboard Equipment Company, of Bethlehem, Pa.

ROPE TRANSMISSION.—The fourth edition of the "Blue Book of Rope Transmission," issued by the American Manufacturing Company, 65 Wall Street, New York, contains much practical information concerning the design, installation and operation of rope transmission system.

TELEPHONE SWITCHBOARDS.—The Dean Electric Company, of Elyria, Ohio, has issued a large and handsome Bulletin No. 105 relative to its common battery switchboards. It is an admirable piece of technical description and is well illustrated in regard to all the details of the equipment.

HOLOPHANE CLUSTERS.—In No. 4 of Vol. 1 of the "Holophane," issued by the Holophane Company, New York, much information is given concerning the adaptability of the Holophane system to old or new lighting installations. The flexibility of the Holophane clusters is also demonstrated.

GERYK AIR PUMPS.—The Pulsometer Engineering Company, Ltd., Nine Elms Iron Works, Reading, England, has issued a neat pamphlet relative to its Geryk air pumps used in incandescent lamp factories in connection with exhaustion processes, chemical and otherwise, and also for flashing the filaments.

STANDARD ACCUMULATORS.—An excellent catalogue has just been issued by the Standard Electric Accumulator Company, of 141 Broadway, with regard to the cell that was recently illustrated and described in these pages—the cell with "the plate that cannot buckle." A very complete account is given of this type of battery in the pamphlet.

LIGHTNING TRANSFORMERS.—The Allis-Chalmers Company, Milwaukee, Wis., has just issued a small four-page folder devoted to its lighting transformers for use on 1050 and 2100-volt primary circuits and are made in sixteen sizes up to 50-kw capacity. They are designed for 60 cycles, but can be operated on any frequency from 50 to 140 cycles.

BENJAMIN SPECIALTIES.—The Benjamin Electric Manufacturing Company has received official notice, under date of Jan. 20, from the Underwriters' Laboratories, that the new "Benjamin Separable Wireless Cluster," described in the Electrical World of Jan. 4, and generally advertised, has been approved and is now regular National Code standard.

ELECTRIC FANS.—Bulletin No. 63 of the Robbins & Meyers Company, Springfield, Ohio, is a well illustrated publication dealing with "Standard" direct-current and alternating-current ceiling, exhaust, bracket and desk fans. The direct-current motors are of the series-wound type, while the alternating-current motors are of the single-phase, self-starting induction type.

HYATT ROLLER BEARINGS are the subject of a special bulletin just issued by the Hyatt Roller Bearing Company, of Newark, N. J. It embodies data on the tests in the locomotive shops of the Buffalo, Rochester & Pittsburg Railway, at Dubois, Pa., which has a large Westinghouse electric plant. Data are given as to the various sections of the motor-driven plant and the economies due to the reduction of friction in line shaft and countershaft.

CAMP-DUCT is the title of a handsome new pamphlet just issued in small quarto form by the H. B. Camp Company, of New York, Pittsburg and Chicago. It is an admirable publication and compilation, giving fully the requirements for conduit work in the way of specifications, contract forms, drawings of manholes, cross-sectional areas of conduits and other data. Copies can be had on application to Mr. S. A. Douglas, Flatiron Building, New York, and the other offices, and are decidedly worth securing.

VARIABLE SPEED MOTORS.—The Northern Electrical Manufacturing Company, Madison, Wis., has issued a pamphlet setting forth some facts about its single-voltage variable-speed motor system. An historical account is given of the development of the motor during the past five years, in which it is stated that the Northern company was the first to advocate broadly the system of single-voltage shunt-field control, which is claimed to be to-day the only accredited system for variable speed.

BECK FLAMING ARC LAMPS.—The Western Electric Company is about to issue a new bulletin covering this lamp, fully descriptive of the most recent and important developments and with full data covering performance. Lamps as now manufactured are suitable for use on either alternating or direct currents and have been so greatly simplified in construction that but little skill is required in operating. This line of arc lamps will supplement the already well-known line of enclosed arc lamps manufactured by the Western Electric Company.

COMMUTATING-POLE MOTORS.—The Electro-Dynamic Company, Bayonne, N. J., has issued an interesting series of circulars dealing with adjustable-speed commutating-pole motors. Circular No. 32 describes motors for general purposes; Circular No. 33 deals with motors for driving machine tools, blowers, pumps, elevators, printing presses, etc.; Circular No. 34 contains numerous illustrations of direct-connected and belt-connected motor-driven equipments, while Circular No. 35 gives dimensions of adjustable-speed and constant-speed commutating-pole motors.

MERCURY-VAPOR LAMPS for both direct and alternating current are described in bulletins recently issued by the Cooper Hewitt Electric Company, 220 West Twenty-Ninth Street, New York. Bulletin No. 15 deals with type H automatic indoor type lamps for direct current. Bulletin No. 16 is devoted to a vapor-converter outfit for operating direct-current lamps from alternating-current circuits. Instructions for installing type H and type K direct-current lamps are contained in book No. 30,162, while book No. 30,163 gives similar instructions for installing type P automatic direct-current mercury-vapor lamps.

LIFTING MAGNETS.—"Lifting Magnets and Recent Improvements in Them" is the title of a booklet just issued by the Cutler-Hammer Clutch Company, of Milwaukee, Wis., maker of lifting magnets and magnetic clutches. The subject matter of this booklet originally appeared in a magazine. This booklet, which is printed in the form of a miniature magazine, traces briefly the development of the lifting magnet, illustrates the different kinds of magnets used for handling pig iron, metal plates and other classes of material and explains, by an easily understood analogy, how the magnetic "lines of force" support weights ranging from one to ten tons. Copies may be had free by addressing the Cutler-Hammer Clutch Company, Milwaukee.

PENNSYLVANIA TERMINAL.—The New York Passenger Terminal of the Pennsylvania Railroad is the subject of a very interesting pamphlet just issued by Westinghouse, Church, Kerr & Company, of New York City. It was prepared for the recent meeting of the American Society of Civil Engineers and is now given more general circulation. It consists of twenty-three pages of cuts and illustrations and gives a clear and concise account of this great engineering enterprise, which devastating a mediocre region of New York has created in its place the greatest railroad center, terminal and tunnel system on this continent. The hole in the ground, yielding 3,000,000 cubic yards of material, is now being crowded with a stately palace of transportation, into which enter 25,000 tons of steel, while the allied structures take another 25,000 tons. The station proper will be lighted chiefly by Cooper Hewitt lamps.

GRAPHITE BRUSHES.—A twelve-page booklet has just been issued by the Joseph Dixon Crucible Company, Jersey City, N. J., entitled "Dixon's Graphite Brushes," which will be of interest to all who have used graphite brushes or contemplate their use. Even those connected with the electrical industry who are not especially interested in the subject of brushes will find the information contained worth the reading. The booklet begins with a description of the electrical installation of the Dixon Company, explaining how Dixon's graphite brushes were first tried. Under headings of "Conditions of Service" and "Variables in Commutation," the conditions are pointed out under which graphite brushes are best used and the requirements set forth which must be met in their use. There are some useful hints in the book of a general nature concerning the brush tension and how to easily measure it, the care of the commutator, etc.

TESTING SETS.—A publication recently issued by the Leeds & Northrup Company as a catalogue of portable testing sets and cable testing apparatus is in reality an excellent 119-page textbook on the subject indicated. The book has been prepared in such a way that it will not only be useful to those who use the apparatus described, but will also be of assistance in increasing exact information in regard to methods of locating faults. The directions are so worded as to be easily understood by men who have occasion to do testing but have not had the advantage of a technical school training in electrical measurements. The use of algebraic expressions has been limited to those cases where their avoidance would require a cumbersome statement which would be more difficult to understand than the algebra itself. Considering the book as a catalogue, it contains the novel feature of an index that serves as a condensed list, giving a very brief statement of the range of each instrument and its price.

SERIES LUMINOUS ARC RECTIFIER SYSTEM.—The series luminous arc rectifier system developed by the General Electric Company, Schenectady, N. Y., permits the operation of direct-current luminous arc lamps from alternating current central stations at high economy and with extreme simplicity, and is described in Bulletin No. 4556, recently issued. The General Electric luminous arc lamp and the auxiliary apparatus, consisting of oil cooled rectifier tube, constant current transformers and switchboard panels, with the necessary control apparatus, reactance coils, etc., are described and their operation explained. In the General Electric luminous arc lamp the upper electrode is a bar of hard-drawn copper, and the lower electrode is made of specially prepared composition contained in an iron tube $\frac{5}{8}$ of an inch in diameter by 8 inches long. This lamp is claimed to be superior to other commercial lamps in efficiency, distribution of light, color of light and low maintenance cost and is particularly well suited to street lighting. The light is as white as any artificial light in commercial service to-day and it has a spectrum which is practically the same as that of sunlight. The standard switchboard sets are designed for 12, 25, 50 and 100 lights and include all the necessary apparatus, such as ammeter, plug switches for operating the different circuits, indicating lamp, starting switch, etc. One of the main advantages of the system is its adaptability to circuits of any frequency from 25 to 100 cycles. A partial list of equipments furnished by the General Electric Company gives an aggregate of over 12,000 lamps already installed.

WESTINGHOUSE AIR COMPRESSORS FOR LIQUIDS.—Westinghouse compressors, both steam and motor driven, have been found so well adapted to handling liquids that they are now extensively employed for compressing air to raise or convey liquids in breweries, tanneries, oil wells, dairies, hospitals, chemical laboratories and acid plants, in addition to all kinds of water wells. Though the problem of pumping by compressed air with given conditions is a simple one, conditions differ so widely that it is impossible to arrive at a satisfactory solution by mathematical analysis. Results of actual tests are necessary to form a correct basis of figuring. Realizing this and desirous of assisting their patrons in every possible way to obtain the best results, the Westinghouse Air Brake Company has lately completed a series of nearly 2000 tests, covering a range of from 350 to 400 different conditions of deep-well pumping, to obtain data concerning water delivered, air consumed and the best proportion and arrangement of piping and apparatus. Heretofore tests have been made on wells having fixed conditions, and the results, covering a number of isolated cases, have been the only guide in considering the requirements for all other installations. In this case, however, the tests were made with a well driven on the premises of the Westinghouse Air Brake Company specially fitted up for experimental work. So far as is known, no such wide range of tests has ever before been made upon a single well. The results place the manufacturers in a position to be of great assistance to those desiring to install compressors for direct air pressure pumping.

Unclassified Items.

BOSTON, MASS.—The Massachusetts Railroad Commission has approved an issue of $700,000 in bonds for the West End Street Railway Company, the proceeds to be used to pay the Boston Elevated Railway Company, lessor of the West End Street Railway, for additions and improvements to the property.

PORTLAND, ORE.—The Mt. Hood Railway & Power Company has installed a power plant at the site of its large Bull Run power development. The plant operates under a head of 680 ft., using water from Deer Creek, and will generate electricity to operate sawmills, planers, mixer, etc., and to furnish electricity for lighting during the construction of the plant.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company is now furnishing electrical energy from its Hen Island power plant to operate the Chicago, South Bend & Northern Indiana Railway, which connects South Bend with Mishawakee, Elkhart and Goshen.

DANIELSVILLE, PA.—The Blue Ridge Traction Company has filed with the Secretary of State a notice of extension of its road from Walnutport to Poplar Grove, Cherryville, Alliance, Weaversville and Bath; also from Alliance to Catasauqua, a total distance of 16 miles.

WHEATLAND, PA.—The Wheatland Street Railway Company has filed a notice of extension of its railway from Wheatland to West Middlesex, a distance of 2½ miles; also a distance of 800 ft. on Church Street in Wheatland.

FORT MORGAN, ALA.—Bids will be received until Feb. 27 by Captain L. F. Garrard, Jr., office constructing quartermaster, for furnishing and installing two 50-hp tubular boilers, two compound duplex pumps, one 150-hp feed-water heater and purification system, feed pump and inspirator.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received until Feb. 21 by John T. Hume, treasurer, Southern Branch of the National Home for Disabled Volunteer Soldiers, for furnishing material and remodeling electric wiring in pavilion and theatre.

DAKOTA, N. D.—The citizens are considering the question of establishing a municipal electric light plant.

MILFORD, OHIO.—The Cincinnati, Milford & Loveland Traction Company is extending its transmission lines to Plainville, Newtonville and Terrace Park for the purpose of furnishing electricity for lamps in the above towns.

ELSINORE, CAL.—The City Trustees have adopted a resolution calling for a special election to be held Feb. 27 to vote on the proposition of issuing bonds to purchase the local electric light plant to be operated by the city.

LAFAYETTE, IND.—City Attorney Arthur D. Cunningham states that the question of establishing a municipal electric light plant must be decided by a special election.

SANTA BARBARA, CAL.—The power house of the Merchants' Mutual Light & Power Company on Santa Barbara Street was partially destroyed by fire recently.

HOUSTON, TEX.—Arrangements are being made by Reed & Slusher, who have charge of the construction of the automatic telephone system for the city of Houston, for the erection of the plant, work on which will soon begin. The company plans to construct at least 15 miles of underground conduits. S. D. Levings is constructing engineer.

SALMON, IDAHO.—The Andrews Light & Power Company is making arrangements to construct its plant and will require equipment for a 500-hp hydro-electric plant, including generators, water wheels, line material, etc. Allen C. Merrill is engineer.

THE ELECTRIC DRY BRUSH WINDOW CLEANER COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State with a capital stock of $10,000. The directors are Alfred H. Speake, of Brooklyn; Joseph T. Willis, of New York, and Walter Ward, of Hackensack, N. J.

THE DAVID KILLOCH COMPANY, of New York, N. Y., has been incorporated with a capital stock of $6,000 for the purpose of manufacturing electrical appliances. The directors are N. Killoch, of Brooklyn; James Killoch, of New York, and William M. Greene, of Coxsackie, N. Y.

THE EMPIRE BATTERY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Charles Vincent, K. L. Franklin and Louis Rosenberg, of New York, N. Y.

THE NORMAN TELEPHONE & CONSTRUCTION COMPANY, of New York, N. Y., and Guthrie, Okla., has filed articles of incorporation at Guthrie, Okla., with a capital stock of $25,000. The directors are J. F. Faunt, R. B. Lee Roy, of New York, N. Y., and E. L. McKeown, of Guthrie, Okla.

THE FRENCH ELECTRO MANUFACTURING COMPANY, of Trenton, N. J., has been incorporated with a capital stock of $25,000 by Theodore G. Kitchin, P. N. Van Vliet and Jonathan Kitchin. The company proposes to manufacture electrical appliances.

TUSCUMBIA, MO.—The Tuscumbia Telephone Company has been incorporated by W. D. Dickson, C. E. Noell, L. N. Musser and others.

VENUS, TEX.—The Venus Telephone Company has been incorporated with a capital stock of $3,000 by A. D. Frost, J. W. Bassett and C. L. Barker.

WATERTOWN, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Jefferson County Telephone Company. The capital stock of the company is placed at $4,000, and the directors are Charles Harth, S. V. Baker, C. E. Brown, G. R. Hanford, G. A. Lance, F. P. Rhines and N. D. Yodt, of Watertown.

AGUILAR, COL.—Articles of incorporation have been filed for the Aguilar Light & Power Company with a capital stock of $25,000 by E. G. Hawkins, Fred Bartlett and others.

STRAWBERRY PLAINS, TENN.—The Strawberry Plains Telephone Company has been incorporated with a capital stock of $5,000 by I. N. White, J. W. Brown, J. P. Cater, W. E. Parrott and Dr. H. L. Campbell.

HENRIETTA, MICH.—The State Road Telephone Company has been incorporated with a capital stock of $1,600 by Henry Lee, W. W. Ford and W. R. Garfield.

BOISE, IDAHO.—The Kings Hill Irrigation & Power Company has been organized by Charles Hammett, C. B. Huritt, E. L. Hice and others to construct a power plant.

GOLCONDA, ILL.—The Golconda Light & Water Company has been incorporated with a capital stock of $12,000 to operate a water and light plant. R. Gilbert is one of the incorporators.

BILLINGS, MO.—The Billings Light, Power & Water Company has been incorporated with a capital stock of $35,000 by S. F. Bronson, J. B. Berghaus, J. W. York and others.

HENRIETTA, MICH.—The Busy Bee Telephone Company has been incorporated with a capital stock of $1,000 by A. G. Moeckle, S. H. Clark and F. Atwood.

CHIPPEWA LAKE, MICH.—The Chippewa Lake Telephone Company has been incorporated with a capital stock of $2,000.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Cincinnati, Madison & Western Traction Company with the Secretary of State with an initial capital stock of $10,000.

MR. THOMAS K. GLENN, vice-president of the Georgia Railway & Electric Company, of Atlanta, Ga., has resigned to become president of the Atlanta Steel Hoop Company, and will be succeeded by his brother, Mr. W. H. Glenn, now superintendent of construction of the company.

MR. J. FRANK CHAPMAN, who was president of the Chapman Electric Company, of Louisville, Ky., died recently at his home, Howard Park, Ind. Mr. Chapman for years had made a business of equipping steamboats with electric motors.

Business Notes.

THE ROBBINS & MYERS CO., whose main office and factory are located at Springfield, Ohio, has recently opened a branch store in Dallas, Tex., with office and sales-room at 264 and 266 Live Oak Street, managed by Mr. W. M. Brooke. Mr. Brooke is experienced in this line and will make a good manager for this branch. All business will be done in the name of the Robbins & Myers Co., and all invoices and collections will be made from its home office at Springfield, Ohio. It will carry in stock and on display at Dallas a full line of motors which they manufacture up to and including 15-hp, and direct-current and alternating-current ceiling, desk, bracket, oscillating desk, and small exhaust fans, all known and sold as "The Standard." These goods have gained an enviable reputation and demand, and as prompt delivery is frequently a most important matter, the company will be able to take good care of the trade by shipping from the Dallas stock or from the factory. With the addition of a complete line of alternating fans to their well-known and established line of direct-current fans, it can be said that the Robbins & Myers Company has absolutely the most complete and select line of fans.

THE NEW CHICAGO GRIP, of Mathias Klein & Sons, 87 West Van Buren Street, Chicago, was shown at the recent Electrical Show, as well as their sliding wedge grip. This latter form is made of steel and has hardened jaws, and its peculiar feature is that it is so arranged that the jaws work in unison. If one is pushed forward, it carries the other with

it simultaneously. This makes it a very effective grip for handling trolley or messenger wire, as it has jaws of considerable length, so that the wire cannot be injured in the least when the grip is applied.

THE ELECTRIC SUPPLY & CONSTRUCTION COMPANY, of Columbus, Ohio, will shortly move to the Schumacher Building, corner of Gay and Third Streets, where larger and more commodious offices have been secured.

MESSRS. PEET AND POWERS, electrical engineers and contractors, whose offices in the Parker Building, at Fourth Avenue and Eighteenth Street, New York, were completely destroyed by fire, have established permanent headquarters at 45 West Thirty-Fourth Street, New York.

DOSSERT SOLDERLESS TERMINAL LUGS are used throughout on all the lighting and power panels, as well as the switchboards, installed in the new eleven-story, fireproof Joseph J. Little printing building, Twenty-second Street, near First Avenue, New York City, by E. C. Tibbals & Company.

THE TOLEDO ELECTRIC SIGN COMPANY, of Toledo, Ohio, through a contract with the S. H. Robinson Company, of Philadelphia, Pa., will hereafter furnish all the all-metal scroll signs used in Philadelphia and Atlantic City. The Toledo company has also secured the contract for furnishing the scroll signs for Nixon & Erlanger's circuit of eighty-five theatres.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY, Madison, Wis., announces the removal of its St. Paul office from 21 East Fifth Street to 516 Endicott Building, St. Paul. Mr. T. E. Drohan is in charge of the new office and is ready to act promptly on inquiries regarding apparatus. His extensive experience as superintendent of the Northern shops at Madison renders him especially fitted to help customers in the arrangement of motor drives for use with machines of all sorts.

ROYAL-EASTERN COMPANY.—The Royal Electrical Supply Company, of New York City, and the Eastern Electrical Supply Company have consolidated under the name of the Royal-Eastern Electrical Supply Company, and will occupy the store and basement of the new building at 114-116 West Twenty-seventh Street, New York City, where the concern will carry a stock of electrical house goods, lighting material, motors and generators. Messrs. C. P. Scott and J. D. Sweeney make the announcement for the two old companies.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JAN. 28, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

877,537. METHOD OF ELECTROLYZING SALTS; Joseph Whiting, Niagara Falls, N. Y. App. filed April 24, 1906. Renewed June 21, 1907. The method of effecting electrolytic decomposition of salts, consisting in passing an electric current through the electrolyte to a mass of liquid metal, and maintaining substantially the same mass of liquid metal as a cathode for a period of time, then, while maintaining a body of electrolyte in the decomposing chamber, withdrawing the mass of liquid metal, and replacing it with a fresh mass of liquid metal, the same angular relation between the adjacent surfaces of the electrodes being maintained throughout the cycle of operations, substantially as described.

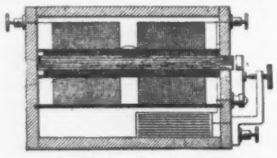
877,555. TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed March 25, 1905. Covers a telegraph transmitter having a key movable in a horizontal plane between two contacts and actuating relays which transmit dots and dashes, respectively.

877,576. SERIES PARALLEL POLARITY CHANGING SWITCH; Edwin S. Lincoln, Brookline, Mass. App. filed Feb. 11, 1907. Covers a double-throw switch adapted to put batteries in series or parallel.

877,656. SPARK-COIL; August R. Luschka, Chicago, Ill. App. filed Oct. 29, 1906. The coil is made in two sections, and the condenser is wrapped about the grounded or low potential section so as to prevent leakage between the secondary winding and the layers of the condenser.

877,684. ELECTRIC INSTALLATION OUTLET BOX; Wheeler H. Vibber, New London, Conn. App. filed June 11, 1907. Form of outlet box having a cover and a body portion suspended from the cover and entirely removable therefrom.

877,705. ELECTRIC CURRENT CONTROLLER; Albert E. Dion and Charles E. Ball, Ottawa, Ontario, Canada. App. filed Nov. 19, 1906.



877,656.—Spark Coil.

Provides means whereby if more than a certain number of lamps are put on a certain circuit the potential will fluctuate therein so that the light will be unpleasant.

877,727. TELEPHONE EXCHANGE; Nils E. Norstrom, Chicago, Ill. App. filed Oct. 4, 1901. The combination with a movable contact maker, and a power device for giving it a forward movement, of an adjustable locking device adapted to stop the forward movement of said contact maker at any desired point, and means by which, upon a backward movement of said contact maker, said locking device will be released so as to permit a subsequent forward movement thereof.

877,730. MEANS FOR OBTAINING THIN LIQUID DROSS IN ELECTRIC FURNACES FOR METALLURGICAL PURPOSES; Hermann Rochling, et al., Volklingen1on-the-Saar, Germany. App. filed Sept. 7, 1906. In an electric furnace of the type described, a smelting hearth, damlike ridges *g*, *h*, arranged within the smelting hearth and smelting channels *d* projecting upwards to such a height above the bottom, that the top edges of the ridges may be flush with the surface of the metal bath, when melted in the furnace whereby the electric current heating the metal bath is forced to pass at these places through the layer of dross floating above the metal bath.

877,790. AUTOMATIC ELECTRIC SWITCH; Mike Mintz, Rock Island, Ill. App. filed May 15, 1906. Has a tilting switch arm moving into a mercury cup and displaced by a float or piston. Is kept at either position of its throw by a rolling ball.

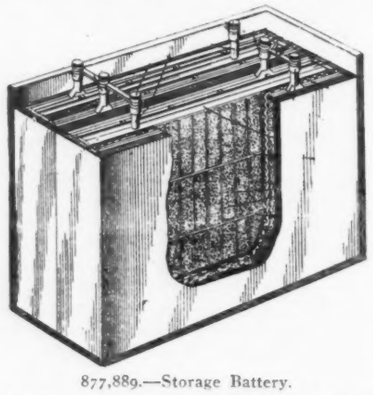
877,804. INSULATOR FOR HEAVY CONDUCTORS; Louis Steinberger, New York, N. Y. App. filed April 17, 1907. Construction of insulator for inverted third rails. The insulator has a metallic U-shaped core, by which it is strengthened and supported.

877,822. PRINTING TELEGRAPH; John C. Barclay, New York, N. Y. App. filed Jan. 11, 1907. Printing telegraph of a class having finger keys and synchronously operated commutators or "sunflowers" at both the transmitting and the receiving station; covers details of construction.

877,843. ELECTRIC HEATER; Edmund F. Hoskin, Evanston, Ill. App. filed Sept. 19, 1907. A soldering iron having a hollow interior, in which is received a spirally wound resistance element. The copper is cast around the insulated resistance element so as to exclude air therefrom.

877,844. TROLLEY; August W. Huhsman, Staunton, Ill. App. filed May 25, 1907. The harp carries vertically projecting cheeks or bearers, with engaging rollers which close together over the trolley wire.

877,857. TELEGRAPH SWITCH; Lewis H. Parcels, Hiawatha, Kans. App. filed Aug. 5, 1907. Telegraph switch for connecting a resonator sounder into one or more sets of telegraph instruments without disturbing the circuits, but allowing all local circuits to work free and clear when the resonator is cut out.



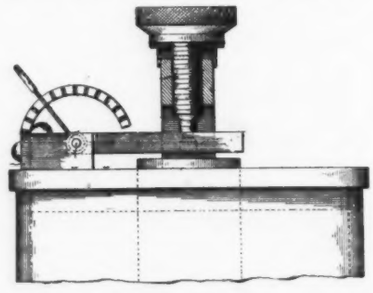
877,889.—Storage Battery.

877,877. WIRE RETRIEVING ATTACHMENT FOR TROLLEY WHEELS; William C. Althen, Columbus, O. App. filed March 22, 1907. A U-shaped frame is suspended from the trolley harp and is raised into a position to guide the wheel on the wire when tension is put on the usual holding cord.

877,880. OUTLET BOX; Harry Becker, Baltimore, Md. App. filed Feb. 1, 1907. An outlet box having a circular open face, in which is received a specially shaped bushing and a threaded ring or nut.

877,887. CONTROLLER REGULATOR; Cyrus P. Ebersole, Keokuk, Ia. App. filed Sept. 1, 1904. Provides a regulator for an electric motor controller to prevent the operator from moving the handle too rapidly. Has vertically sliding pins, which are progressively displaced by a cam.

877,889. STORAGE BATTERY; William Gardiner, Chicago, Ill. App. filed May 2, 1905. Has a lead grid with vertically disposed ribs having inwardly projecting teeth, the active material filling the spaces between the ribs and held in place by the teeth.



877,896.—Vibrator.

877,896. VIBRATOR; August R. Luschka, Chicago, Ill. App. filed Nov. 19, 1906. Has a hammer or interrupter comprising a plate of metal hinged to a fixed bracket and an adjustable spring connected thereto.

12,744. ELECTRIC MOTOR CONTROLLER REGULATOR; Paul A. Weyand, Maywood, Ill. App. filed March 18, 1907. A mechanism for preventing too rapid movement of a controller handle and including a plurality of upwardly projecting inclined teeth, which operate with a ratchet so as to procure a successively operated release thereof.